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A TAXONOMIC REVISION OF *NICOTIANA* (SOLANACEAE) IN AUSTRALIA

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Abstract

A taxonomic account of *Nicotiana* in Australia is presented, together with a key to the species and subspecies, and distribution maps. 16 endemic and 1 introduced species are recognized. Two new subspecies are described: *N. debneyi* subsp. *monoschizocarpa* and *N. megalosiphon* subsp. *sessilifolia*. Two new combinations are effected: *N. occidentalis* subsp. *hesperis* (formerly *N. hesperis*) and *N. rosulata* subsp. *ingulba* (formerly *N. ingulba*). *N. exigua* is treated as a probable synonym of *N. suaveolens*.

Introduction

Nicotiana comprises about 63 species which range from small annuals to woody, subarborescent shrubs. They are distributed in North and South America (15 and 36 species respectively, 45 in all, Goodspeed, 1954), south-western Africa (one species, Merxmüller & Buttler, 1975), some southern Pacific islands (one species) and in Australia where 17 species occur in areas collectively covering most of the continent. One of these 17, *N. debneyi*, also occurs on Lord Howe Island and in New Caledonia, and another, *N. glauca*, is introduced. No species occur in Tasmania.

The most recent world-wide account of *Nicotiana* is the comprehensive monograph of Goodspeed (1954), in which the taxonomic treatment of Australian species is largely based on the work of Wheeler (1935) who recognized 14 Australian species of which 6 were new. Goodspeed placed the Australian species, together with one species (*N. fragrans*) from southern Pacific islands, in the section *Suaveolentes* of the subgenus *Petunioides* The section is distinguished by the lowest anther being on the longest filament (although not always so in *N. debneyi*) (Goodspeed, 1945, 1954). A revision of the Australian species of the genus was published by Burbidge (1960), which included descriptions of 5 new species and 2 new subspecies. Since Burbidge's revision, many more field collections of Australian *Nicotiana* have been made which in some cases have greatly extended the previous known ranges of their respective species, and which have further illuminated their taxomonic relationship.

This account is presented as one of a series of revisions of genera of the Solanaceae in Australia conducted at the Herbarium of the Waite Institute. Some observations of field specimens were made and several species grown in cultivation, but the study is based primarily on dried herbarium material from the following herbaria: AD, ADW, BRI, CANB, MEL, NSW, NT, PERTH, SYD and the private herbarium of Mr A. C. Beauglehole. Abbreviations for herbaria are those given by Holmgren & Keuken (1974). All specimens seen have been annotated, and all specimens cited have been seen unless otherwise stated.

General notes on morphology

The morphology of Australian *Nicotiana* may vary considerably according to different environmental conditions. Individuals growing under harsh conditions may be stunted with small, narrow leaves and almost leafless stems, but others of the same species growing in wetter and more fertile soil may attain more than thrice the height with leafy stems and large, lush, broad leaves. The calyx, capsule and particularly the corolla may

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likewise vary in overall and relative dimensions, according to the stage of maturity of the plant as well as to environmental factors. Thus the corolla tubes of flowers on older plants are shorter and narrower than usual.

Indumentum

The epidermal vestiture, where present, consists of unbranched multicellular, eglandular or glandular trichomes; hydathodes are usually also present. Burbidge (1960) reported the occurrence of branched hairs in *N. rotundifolia*; I did not find any in the specimens of this or any other species which I examined. The glandular trichomes are of two kinds, one terminating in a single globular cell ("globular-headed") and the other in an ellipsoid-shaped head of several cells ("ellipsoid-headed"). The former render the living plant clammy to the touch, and plants with the latter are distinctly viscid, frequently with seeds, dirt and other fragments adhering to them. These trichome types are illustrated in Fig. 1. The degree of pubescence may vary considerably within the one species or subspecies. For instance, in a normally densely pubescent species, occasional specimens may occur with glabrescent stems. Additionally, older growth is usually more sparsely pubescent than more recent growth, and over-mature plants are always comparatively more sparsely pubescent.

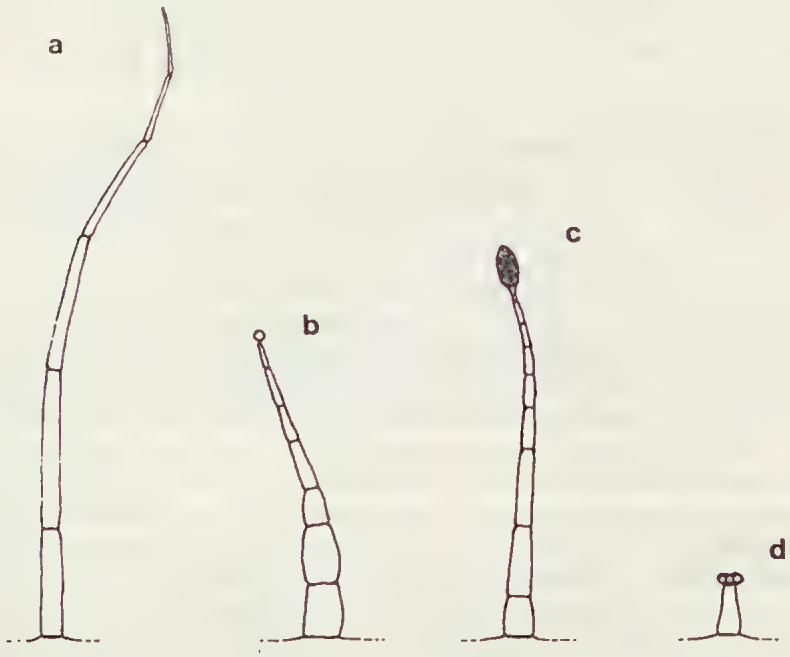


Fig. 1. Trichomes of Australian *Nicotiana*. (a) eglandular; (b) glandular, globular-headed; (c) glandular, ellipsoid-headed; (d) hydathode.

Leaves

The petiole in all Australian *Nicotiana* is winged to a greater or lesser extent, the wing being continuous with the leaf lamina. Thus the petiole is not abruptly distinct from the leaf blade, except for instance in the leaves of *N. cavicola* and *N. umbratica*, the bases of which are mostly cordate. For convenience, the demarcation between petiole and lamina is here taken to be the point at which the leaf margin becomes concave, proximal to the widest part of the leaf.

Pedicels

The pedicels of *Nicotiana* elongate continuously from bud initiation to maturation of the fruit. At anthesis the pedicel is about 1-3 mm long, but in the mature, dry fruit it may vary in length from 15-46 mm, depending upon the species. This latter measurement is therefore stated in the species descriptions.

Corolla

Goodspeed (1954) distinguished the parts of the corolla of *Nicotiana* as follows: "tube proper", "throat cylinder" and "throat cup", all forming the "tubular part", and the "limb". For convenience, this terminology is followed here, except that the "tubular part" is referred to simply as the "tube" (Fig. 2). In most Australian *Nicotiana* the throat cup is hardly distinct from the throat cylinder, and in many the throat cylinder merges directly into the tube proper (that part of the tube below the insertion of the lowest stamen) and cannot be distinguished from it. The corolla lobes are the 5 segments comprising the limb, and their extent of fusion varies from proximally only to almost completely. Their margins may be acute, obtuse, or emarginate.

Cleistogamy

In all species there is at least some incidence of cleistogamy. The corolla in cleistogamous flowers is shorter and proportionately narrower than in chasmogamous flowers and often scarcely exceeds the calyx and may even be shorter than it. The corolla limb remains closed at all times. Cleistogamy in *Nicotiana* can frequently be observed in older plants. It may apparently be induced by short-day conditions (Burbidge, 1960), and might also be influenced by temperature since a specimen of *N. occidentalis* subsp. *obliqua* producing cleistogamous flowers in cultivation at the Waite Institute formed chasmogamous flowers when moved to a warmer glasshouse.

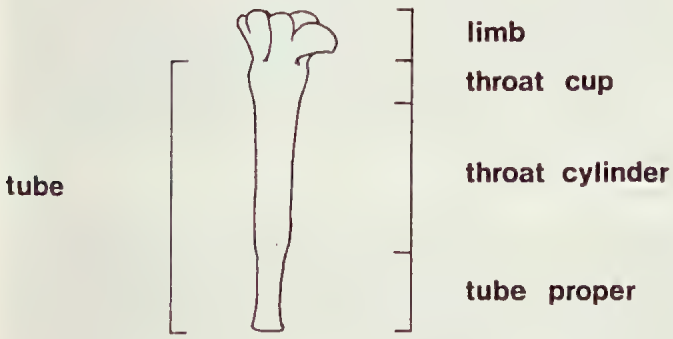


Fig. 2. Terminology of corolla parts.

Fig. 3. Seeds of *Nicotiana occidentalis* subsp. *hesperis*. Upper: not crested; voucher N.T. Burbidge 6485 (CANB). Lower: crested; voucher N.T. Burbidge 6461 (CANB).

Capsules

In all but *N. debneyi* subsp. *monoschizocarpa*, the capsules of Australian *Nicotiana* dehisce along two perpendicular planes. The major dehiscence is partly septicidal and partly septifragal and separates the two valves to near the base. Part of the inner septa remain adherant to each other, together with the placentae, and part splits away leaving a margin along the valves near their base. The secondary dehiscence (which does not take place in *N. debneyi* subsp. *monoschizocarpa*) is loculicidal and splits each major valve in two, for up to about half their length from the apex. The apices of each of the now 4 valves then recurve outwards as the capsule dries.

Seeds

Burbidge (1960) first brought to attention the diagnostic value of seeds of Australian *Nicotiana*. The testa is highly ornamented with sharp or rounded ridges forming honeycombs or wrinkles, and the seed shape varies from oblong, i.e. straight, to tightly curved and C-shaped. A dorsal crest may also sometimes occur on the seeds of *N. occidentalis* subsp. *hesperis* (Fig. 3). Generally only a little variation in seed shape and ornamentation occurs within one species or subspecies, so these are fairly reliable characters for distinguishing between many taxa. Care must be taken with dried herbarium specimens, however, to ensure that the seeds examined are fully mature, otherwise the testa is shrunken and shrivelled to a greater or lesser extent, thus obscuring the seed shape and ornamentation. It is therefore recommended for all future collections of *Nicotiana* that, if possible, mature seeds be collected and placed in a packet with the specimen. Photographs of seeds of all species and subspecies are given by Burbidge (1960), and a few are illustrated here (Fig. 4) to show the range of shape and ornamentation which occurs.

Hybrids

A number of possible hybrids between species of *Nicotiana* were noted. Their morphology was studied in detail and compared with that of the putative parent species. Pollen from several of these specimens was stained with lactophenol aniline blue to estimate pollen fertility and thus possibly to determine further evidence of hybridization. The several apparent hybrids, between Australian *Nicotiana* species and the introduced *N. glauca* are noteworthy in that they are between species from different continents and of different sections of the genus. Hybridization amongst Australian *Nicotiana* species in the field appears to be limited; few collections were seen which, judging by their morphology, might represent such hybrids.

(1) *N. glauca* x *N. suaveolens*

A specimen almost certainly of this hybrid is: *P.R.H. St John s.n.*, south side of Station Peak, You Yangs, Vic., 25.ix.1930 (MEL s.n.). The calyx and corolla of this specimen are intermediate between those of the two parent species, and the leaves have the shape of *N. suaveolens* leaves but the terete petiole of *N. glauca*. No fruits are present on this specimen, and it was annotated by H.-M. Wheeler in May 1934: "Pollen from mounted hybrid flower consists largely of shrunken grains".

This hybrid, from a population in the same area (where both parent species were also growing at the time), was later described by Nicholls (1936) as a distinct species: *N. flindersiensis* (see below). Unlike the St John collection, the hybrids Nicholls found were apparently setting capsules; he made no mention of seeds, however. There is no evidence that a stable population of this hybrid has been maintained and therefore no reason to retain *N. flindersiensis* as a distinct taxon.

N. flindersiensis Nicholls, Vict. Nat. 53:64, pl. VII (1936).

Holotype: *W.H. Nicholls s.n.*, Flinders Peak, You Yangs Range, Vic., date? (MELU, n.v.).

(2) *N. glauca* x *N. simulans*

A possible hybrid between these two species is represented by the following specimen: *E.H.Ising s.n.*, Fish Hole, 32km south of Oodnadatta, S.Aust., 25.viii.1955 (AD 97413287). It was collected together with *N. simulans* and, although no collections of *N. glauca* from that area have been noted, it is possible that it also occurs or once occurred there. The specimens bear glabrous stems and leaves, the latter (mostly radical) the shape of *N. simulans* leaves but with almost terete petioles. The calyx and corolla are similar to those of *N. glauca* but smaller, and the staminal arrangement is similar to that of *N. simulans*, with 4 anthers on short filaments and one on a long filament. The pollen is about 94% fertile, and capsules and seeds were formed. The seeds are intermediate in shape and ornamentation between *N. glauca* and *N. simulans*.

(3) *N. glauca* x *N. goodspeedii*

Almost certainly a hybrid between these two species is: *R.D. Pearce 144*, 17.6km from Blanchetown on Morgan Road, 15.x.1978 (ADW). The glabrous stems are somewhat leafy below the inflorescence, and the leaves, also glabrous, are intermediate in morphology between the two parent species. The calyx and corolla are also intermediate, but the filaments are all long as in *N. glauca*. The pollen is only about 5% fertile and no capsules were set.

(4) *N. maritima* x *N. suaveolens*

A reputed amphiploid strain of such a hybrid was given specific status (*N. eastii*, see below) by Kostoff (1939). The strain was grown by Kostoff from seeds received in 1936 and collected by R.G. May from Bathurst, N.S.W. However, Goodspeed (1954) believed that Kostoff's evidence for the origin of this species was inconclusive and insufficient, and that the strain was probably a tetraploid *N. suaveolens*. Furthermore, *N. maritima* is not known to occur anywhere near Bathurst, so the possibility of its being one parent of such a hybrid is extremely remote.

N. eastii Kostoff, Curr. Sci. 8:110(1939), nom.nud.

(5) *N. aff. benthamiana* x *N. velutina*

A collection: *D.E. Symon 9306*, Dalhousie Springs, S.Aust., 24.ix.1974 (ADW), appears to represent hybridization between *N. velutina* and a population of anomalous *Nicotiana* resembling *N. benthamiana* (see notes under *N. benthamiana*). Both presumed parents were also growing in the vicinity of the hybrid at that time (D.E. Symon, pers. comm. 1978). The habit and sessile nature of the leaves of this plant are like *N. benthamiana*, but the leaves are narrower, more like those of *N. velutina*, and the flowering stems are leafless with racemose or paniculate inflorescences as in *N. velutina*. The flowers are similar to those of *N. velutina* although the corolla is somewhat larger than average. The pollen is only about 4% fertile and no fruits were formed.

(6) ? *N. suaveolens* x *N. velutina*

A group of specimens from north-eastern New South Wales closely resembles

Fig. 4

e

f

g

Fig. 4 (cont.)

Fig. 4. Seeds of Australian *Nicotiana*. (a) *N. megalosiphon* subsp. *megalosiphon* X30, voucher *T.J. McDonald 72* (BRI); (b) *N. megalosiphon* subsp. *sessilifolia* X30, voucher *P.K. Latz 1695* (ADW); (c) *N. debneyi* subsp. *debneyi* X30, voucher *P. Horton s.n.* (ADW 54319, cultiv. from seeds of *A.G. Floyd s.n.*, 12.iii.1979); (d) *N. debneyi* subsp. *monoschizocarpa* X30, voucher *P. Horton s.n.* (ADW 54171, cultiv. from seeds of *C.R. Dunlop 5028*); (e) *N. velutina* X30, voucher *P. Horton 191*; (f) *N. maritima* X30, voucher *P. Horton s.n.* (ADW 51395, cultiv. from seeds of *D.E. Symon 10563*); (g) *N. benthamiana* X30, voucher *P. Horton s.n.* (ADW 51287, cultiv. from seeds of *P.K. Latz 6524*).

N. suaveolens with the exception of their seeds, which are mostly C-shaped and approach those of *N. velutina*. These collections are from an area marginal between the distributions of *N. suaveolens* and *N. velutina*, and so might represent some introgression between these two species (which share the chromosome number n=16). The pollen of one specimen, *W.K. Anderson s.n.*, was tested for viability and found to be about 97% fertile.

The specimens are held at NSW and are:
W.K. Anderson s.n., Narrabri Agricultural Research Station, 31.i.1968 (NSW 128042); *C.W. Antaw s.n.*, Coonabarabran district, 26.vi.1953 (NSW 24229); *G.A. Borthistle s.n.*, Gunnedah, March 1919 (NSW 48806); *B.G. Briggs 2284*, Mt Nombi, 29.ix.1968; *H.L. Jones s.n.*, Coonamble, 25.i.1911 (NSW 48821); *Narr s.n.*, Gunnedah, 7.iii.1941 (NSW 48775); *R. Slack-Smith s.n.*, Coonamble, 12.iv.1977 (NSW 141412); *Anon. (Shire Clerk) s.n.*, Gilgandra, May 1936 (NSW 48767).

(7) ? *N. megalosiphon* x *N. velutina*

A few specimens from mid and southern Queensland appear to be robust individuals of *N. velutina* with the exception of the corolla which is about 35-40 mm long. These collections are from an area in which both *N. megalosiphon* and *N. velutina* occur, and so might represent hybridization between these two species. The pollen from one specimen, *S.T. Blake 12104*, was tested for viability and found to be about 92% fertile.

The specimens are held at BRI and are:
S.T. Blake 10336, Geera, 30.xi.1935; *12104*, Windorah, 13.vii.1936; *S.L. Everist 7442*, Ingella, 3.viii.1963; *K.J. McFarlane s.n.*, Charleville, 14.viii.1960 (BRI 25476); *M.D. Power s.n.*, Blackall, 11.iv.1961 & June 1961 (BRI 28014 & 27694).

Ecology

The Australian species of *Nicotiana* are all annuals or short-lived perennials. Most can be found in specific habitats such as deep sands or rocky outcrops, and frequently in the shelter of boulders, under rocky overhangs, or in cave entrances. In general they grow in disturbed or open sites with little or no competition from other plant species, and may often be found in abundance following bushfires or heavy rains after drought. All species contain one or more pyridine alkaloids (Willaman, 1961, McBarron, 1976) and have occasionally been suspected of poisoning stock if consumed in large quantities.

Uses

Several species of Australian *Nicotiana* were highly prized by aborigines for use as a chewing tobacco, and were traded widely (for a recent summary of aboriginal use of Australian *Nicotiana*, see Peterson, 1979). The native tobaccos were not smoked but chewed, the leaves being crushed (either fresh or more usually having first been dried) and mixed with wood ash, then rolled into a quid.

NICOTIANA L.

L., Sp. Pl. 1:180 (1753); Gen. Pl. 84 (1754).

Type species: *N. tabacum* L., Sp. Pl. 1:180 (1753), lectotype, vide Britton & Brown, Ill. Fl. N.U.S. ed. 2, 3:170 (1913).

Annual or short-lived perennial herbs, often malodorous, with 1 to several erect or ascending stems occasionally woody at the base, (or a spindly perennial shrub with one or a few main woody stems). *Indumentum* varied, stems and leaves glabrous to pubescent with simple, multicellular, eglandular or glandular trichomes, often eglandular on proximal parts and becoming glandular more distally along stem, often with inflated cells; young growth, leaf veins and often margins more densely pubescent than other

parts; pedicels and calyx sparsely to densely pubescent with simple, multicellular, eglandular or usually glandular trichomes, many with inflated cells; corolla pubescent outside with short, usually eglandular trichomes, and glabrous inside except for eglandular trichomes near base of tube. *Leaves* alternate, exstipulate, petiolate or lower leaves petiolate to sub-petiolate and upper leaves sessile; usually numerous radical leaves in basal rosette merging into few or numerous cauline leaves, or leaves mostly cauline; *cauline leaves* becoming shorter and proportionately narrower more distally along stem and often merging into bracts of inflorescence; *lamina* simple, entire or with sinuate margins, occasionally undulate; *petiole* very narrowly to broadly winged, the wing continuous with lamina, (or petiole terete), becoming shorter in proportion to leaf length the more distal the leaf.

Inflorescence usually a loose, elongate panicle, rarely racemose, (or a short, dense panicle), the flowers subtended by bracts, or flowering stems leafy, the flowers solitary and subtended by leaves; flowers pedicellate; *bracts* lanceolate to linear, or occasionally leafy at base of inflorescence but always becoming smaller and narrower distally; *pedicels* erect or cernuous, lengthening in fruit. *Calyx* regular or slightly irregular, tubular or narrowly campanulate, shorter than corolla, usually enlarging slightly in fruit; *sepals* 5, fused basally to almost entirely, usually slightly unequal, often slightly conduplicate but flattening out in fruit. *Corolla* regular or slightly irregular, salverform, white and often tinged creamy-green or purplish on the outside, (or yellowish), often sweetly-scented; *tube* differentiated into throat cup + throat cylinder + tube proper, or little differentiated; *throat cup* often asymmetrically swollen; *limb* 5-lobed, contorted-plicate in bud and spreading at anthesis, thereafter loosely folding in light and expanding in shade or darkness, (or remaining open in sunlight). *Stamens* 4+1, included or rarely slightly exserted, the 4 upper ones at mouth of or in throat cup and often subdidynamous or didynamous, the lower one below the throat cup, (or all 5 in throat cup); *anthers* 2-celled, elliptic, dorsifixed, longitudinally dehiscent; *filaments* filiform, inserted on corolla tube, those of the upper 4 stamens fused to corolla for all but their distal fraction and that of the lower one fused for a considerably shorter length, or the filaments all fused to the corolla near the base only. *Ovary* superior, bilocular, *placentation* of the numerous ovules axile; *disc* short, hypogynous, annular, often orange-red; *style* terminal on ovary, filiform, extending to distal end of corolla tube; *stigma* slightly 2-lobed, discoid-capitate.

Fruit an ellipsoid or ovoid, thin-walled, 2-celled capsule, surrounded by persistent calyx, at first green, becoming brown at maturity; dehiscence septicidal-septifragal and loculicidal (i.e. splitting the capsule into 4 valves) (see Notes on morphology), or septicidal-septifragal only (i.e. splitting the capsule into 2 valves; this occurs only in *N. debneyi* subsp. *monoschizocarpa*). *Seeds* minute, numerous (95-400 per capsule), light to dark brown, almost straight, angled, reniform or tightly curved; ornamentation of testa reticulate, with or without wavy ridges, or of round-edged wrinkles.

The following infrageneric classification was proposed by Goodspeed (1945) to include all native Australian and South Pacific Island species:-

Subgenus **Petunioides** (Don) Goodspeed, Univ. Calif. Publ. Bot. 18:339 (1945).

Type species: *N. acuminata* (Graham) Hook., Bot. Mag. 56, tab. 2919 (1829).

Section **Suaveolentes** Goodspeed, Univ. Calif. Publ. Bot. 18:342 (1945).

Type species: *N. suaveolens* Lehm., Gen. Nicot. 43 (1818).

Key to Species in Australia

1. Perennial, spindly shrub to 6m high; corolla yellow ..... 17. *N. glauca*

   Annual or short-lived perennial herb usually under 1m high; corolla white (may be tinged purple or green on outside) 2

2. Sticky ellipsoid-headed trichomes present at least in inflorescence 3
   Sticky ellipsoid-headed trichomes absent 9
3. Laminae of lower leaves nearly as broad as or broader than long; cauline leaves petiolate 4
   Laminae of lower leaves longer than broad; at least the uppermost cauline leaves subsessile or sessile 5
4. Petioles broadly winged; corolla lobes obtuse ..... 2. *N. cavicola*
   Petioles very narrowly winged, almost terete; corolla lobes acute ..... 3. *N. umbratica*
5. Inflorescence many-branched when mature (third-order branching common), leafless; corolla lobes obtuse to acute; seeds oblong or trapezoid 6
   Inflorescence few-branched when mature (usually second-order branching at most), often somewhat leafy in lower part; corolla lobes emarginate; seeds reniform to U-shaped 7
6. Corolla lobes broad, obtuse; capsule 4-valved; seed testa wrinkled ..... 1. *N. debneyi* subsp. *debneyi*
   Corolla lobes narrow, acute to narrowly obtuse; capsule 2-valved; seed testa honeycombed ..... 1. *N. debneyi* subsp. *monoschizocarpa*
7. Corolla tube usually longer than 30 mm, always longer than 25 mm; upper 4 stamens level ..... 4. *N. occidentalis* subsp. *occidentalis*
   Corolla tube usually shorter than 35 mm; if longer than 25 mm then upper 4 stamens subdidynamous 8
8. Seeds bent into a U-shape, occasionally crested ..... 4. *N. occidentalis* subsp. *hesperis*
   Seeds reniform, never crested ..... 4. *N. occidentalis* subsp. *obliqua*
9. Flowering stems leafy; flowers interfoliar ..... 5. *N. benthamiana*
   Flowering stems leafless above; flowers in racemes or panicles 10
10. Cauline leaves decurrent on stem; plants (excluding flowers) glabrous ..... 6. *N. excelsior*
    Cauline leaves not decurrent on stem; plants (excluding flowers) glabrous or pubescent 11
11. Cauline leaves (always present) broadly auriculate and stem-clasping; seed testa wrinkled 12
    Cauline leaves (if present) not auriculate or stem-clasping, or if somewhat so then seed testa honeycombed 13
12. Corolla tube up to 20 mm long; capsule 5-9 mm long ..... 7. *N. amplexicaulis*
    Corolla tube at least 30 mm long; capsule 8-16 mm long ..... 8. *N. gossei*
13. Plants entirely pubescent; corolla tube usually longer than 25 mm, with length: width usually exceeding 15:1 14
    Plants (excluding flowers) glabrous, or pubescent near base only, or if entirely pubescent then corolla tube shorter than 25 mm, with length:width usually less than 15:1 16
14. Corolla tube usually shorter than 40 mm; upper 4 stamens subdidynamous ..... 10. *N. simulans*
    Corolla tube usually longer than 40 mm; upper 4 stamens level 15
15. Cauline leaves petiolate; seed testa wrinkled ..... 9. *N. megalosiphon* subsp. *megalosiphon*
    Cauline leaves (at least the upper ones) sessile; seed testa honeycombed ..... 9. *N. megalosiphon* subsp. *sessilifolia*
16. Capsule elongate, usually about 3 times as long as broad; plants (excluding flowers) glabrous or sparsely pubescent near base only; corolla tube proportionately narrow (length:breadth more than 10:1, often more than 15:1), 1-2 mm wide; seeds not C-shaped 17
    Capsule not elongate, about twice as long as broad at most; plants glabrous or pubescent; corolla tube narrow to broad; seeds reniform to C-shaped 18
17. Plants (excluding flowers) glabrous or nearly so; corolla tube usually longer than 35 mm; cauline leaves few to several, occasionally absent ..... 11. *N. rosulata* subsp. *ingulba*
    Plants sparsely pubescent near base; corolla tube usually shorter than 35 mm; cauline leaves usually absent ..... 11. *N. rosulata* subsp. *rosulata*
18. Plants (excluding flowers) glabrous; corolla tube narrow, usually less than 3 mm wide; seeds C-shaped ..... 12. *N. goodspeedii*
    Plants pubescent (stems may be glabrescent); if glabrous or nearly so then corolla tube broad (usually 3 mm wide or more) and seeds not C-shaped 19

19. Corolla tube usually longer than 25 mm, broadening distinctly up to limb; plants glabrous or nearly so ..... 13. *N. suaveolens*

    Corolla tube usually shorter than 25 mm, the part distal to calyx almost constant in width; plants pubescent (stems may be glabrescent) 20

20. Seeds C-shaped; pubescence at base of plant not grey- or white-woolly ..... 15. *N. velutina*

    Seeds reniform or angled, not C-shaped; pubescence at base of plant may be grey- or white-woolly 21

21. Pubescence usually grey- or white-woolly at base of plant; intersepalar membranes not very conspicuous; corolla tube 2-5 mm wide ..... 14. *N. maritima*

    Pubescence at base of plant not grey- or white-woolly; intersepalar membranes conspicuous; corolla tube 1-2.5 mm wide ..... 16. *N. rotundifolia*

1. **N. debneyi** Domin, Biblioth. Bot. 89:1147, pl. 36 figs. 6-8 (1929).

Type: *Dallachy s.n.*, Rockingham Bay, ?1868 (K-photo. in ADW, holo.?; none held at PR). A collection (of 2 sheets) held at MEL bears two labels, one: "Rockingham Bay, Dall." and the other in Dallachy's writing: "Herbert River, 12 June 1868, flower white"; this may be an isotype.

Herb to 0.9 (-1.5) m high, with 1 (-3) stems which are leafy near the base. *Indumentum* on leaves and proximal portions of stems of fairly sparsely scattered eglandular trichomes; in inflorescence fairly dense and the trichomes ellipsoid-headed glandular. *Leaves* both radical and cauline, mostly petiolate but the distal ones subsessile to sessile; *lamina* (1.5-)3-17(-25) cm long x (0.2-)1-13.5 cm wide, elliptic (occasionally ovate) or broadly so, to narrow-elliptic or linear at base of inflorescence; apex obtuse on basal leaves, becoming acute, to acuminate on most distal leaves; base obtuse or cuneate (and continuous with petiole) on basal leaves, to auriculate and stem-clasping on most distal leaves; margin entire to slightly sinuate; *petiole* to 9(-14) cm long, broadly winged, somewhat stem-clasping and auriculate at the base. *Inflorescence* a loose, elongate, several-branched panicle (third- and fourth-order branching common), occupying up to $^1/_2$ (rarely more) the length of stems; *bracts* 1-10 mm long, linear to lanceolate; *pedicels* to 19 mm long in fruit. *Calyx* 4-10 mm long; sepals lanceolate to linear-lanceolate, subequal to unequal (rarely equal), fused for $^1/_2$-$^2/_3$ their length; intersepalar membranes inconspicuous. *Corolla tube* (10-)14-20(-23) mm long; tube proper usually distinctly narrower than throat cylinder; throat cup usually indistinct, symmetrical or slighty asymmetrical; *corolla limb* 6-13 mm diameter, closing in sunlight. Upper 4 *stamens* level or slightly subdidynamous, in throat cup (rarely the longer pair slightly exserted), fifth stamen usually between the 2 of the longer pair (occasionally between the pairs). *Capsule* (5-)6-11 mm long, equalling or longer than calyx (occasionally slightly shorter), ellipsoid to ovoid or broadly so (length:breadth 2:1 to 3:2). *Seeds* (0.5-)0.6-0.9(-1.0) mm long, broadly oblong-reniform or trapezoid-reniform.

Notes

Bailey (1901) considered that a specimen collected by *G.L. Debney s.n.*, Monkira Station, Qld, Aug. 1891 (BRI 14168) was distinctive and should bear the name *N. suaveolens* var. *debneyi* (a *nomen nudum*). Domin (1929) quoted this name after describing *N. debneyi* and it seems likely that he took the varietal name and used it for his new species. The Debney specimen is in fact *N. velutina*.

In his notes to *N. debneyi*, Goodspeed (1954) considered *N. forsteri* Roem. & Schult. (based on a plant collected by Forster on the Isle of Pines) to be synonymous with *N. debneyi*. But Heine (1976) believed *N. forsteri* to be synonymous with *N. fragrans*; this treatment of *N. forsteri* is followed here since the type specimen has not been seen by me. In fact, *N. forsteri* appears to be a valid name (vide Roem. & Schult., Syst. Veg. 4:323, 1819).

Subsp. **debneyi**

Corolla tube 1.5-3 mm wide at top of calyx; *corolla lobes* broad (often broader than long), obtuse (rarely slightly emarginate), fused for $^1/_2$ to almost all their length. *Filaments* of upper 4 stamens (4-) 6-11 mm long, of fifth 6-10 mm long, all inserted onto corolla in proximal $^1/_2$ of tube (occasionally those of upper 4 stamens semi-adnate to corolla tube for most of their length, but fused to tube only in their proximal sections). *Capsule* splitting septicidally-septifragally and shortly loculicidally, into 4 valves. *Seed testa* with short, sharp-edged wrinkles or very wavy-edged honeycombs. (Figs. 4c, 5a).

Chromosome number: n = 24 (Wheeler, 1935:51).

Distribution and habitat

This subspecies occurs along the eastern regions of Queensland (south of Cairns) and New South Wales (north of Nowra) (Fig. 14). It is also found on Lord Howe Island and in New Caledonia.

The habitat of this subspecies is variable: sandy, clay, loam or rocky soils in or on rocky coastal headlands, deep gorges and cave openings, margins of rainforest, or soft-wood scrub.

Notes

The only specimen seen from New Caledonia (*Anonymous s.n.*, New Caledonia, *s.dat.* [BRI 239738]) differs from *N. debneyi* subsp. *debneyi* only in that the corolla is slightly more robust than is usual in the Australian specimens.

Two collections are from mid- and western Queensland: *J.H. Simmonds s.n.*, Woolston, 26.i.1888 (BRI 114444); and glasshouse plants grown by N.T. Burbidge, 18.ix.1959, from sample *T.S.232*, the original seed coll. *N.T. Burbidge 5311*, Mount Isa, 26.iv.1956 (CANB). They are representative of subsp. *debneyi* and may perhaps be relicts of a once more widespread distribution of *N. debneyi* which extended from eastern Queensland and New South Wales to western Northern Territory and included the area now occupied by subsp. *monoschizocarpa*.

Selected specimens (total seen about 126)

QUEENSLAND: *N.T. Burbidge 5561*, banks of Bullaroo Creek, Carnarvon Range, 13.ix.1956 (CANB); *M.S. Clemens s.n.*, Ogmore, 1.xii.1947 (BRI 239778); *R. Henderson 294*, Benarkin State Forest, Blackbutt, 8.viii.1967 (BRI); *R.W. Johnson 2814*, 45 km W.S.W. of Moura, 8.ix.1964 (CANB); *L.S. Smith 3461*, Biloela, 21.x.1947 (BRI); *A. Taylor s.n.*, on range in rainforest between "The Head" and Killarney, 20.vi.1957 (BRI 5735); *C.T. White 11359*, Carnarvon Creek, 26.ix.1940 (BRI); *12488*, Marmor, 26.xi.1943 (BRI); *J.H. Willis s.n.*, at mouth of Koolanbilba Cave on eastern slope of Mt Roberts, ca 2 km east of Binna-Burra Lodge, 27.v.1961 (MEL).

NEW SOUTH WALES: *W.M. Carne s.n.*, Horse-shoe Bend, Grose Vale, 2.iii.1910 (NSW 48834); *E.F. Constable s.n.*, Eden Creek, Toonumbar State Forest, 17.iv.1947 (NSW 3724); *R. Henderson 488*, ca 32 km N.W. of Kyogle, 12.xii.1968 (BRI, NSW); *L.A.S. Johnson s.n.*, Yessabah Caves, 23.x.1959 (NSW 48815); *s.n.*, "The Blowhole", Korogoro Point, Hat Head, Jan. 1968 (NSW 141405); *F.A. Rodway 6562*, Cambewarra Range, near Bellawongarah, 29.x.1939 (NSW); *H.M.R. Rupp s.n.*, Mount Johnstone, near Paterson, 6.vi.1927 (NSW 48831).

LORD HOWE ISLAND: *L.A.S. Johnson & A. Rodd 1252*, western end of North Beach, 9.ix.1970 (NSW).

Subsp. **monoschizocarpa** P. Horton, subsp. nov.

Type: *J. McKean 1183*, Daly River Crossing, Daly River road (13° 46'S, 130° 41'E), 28.ix.1973 (NT, holo.; CANB? n.v., DNA n.v., NSW n.v.).

Tubus corollae ad 1.5 mm latus summo calycis. Lobi corollae angusti, semper longiores quam lati, acuti vel anguste obtusi, conjuncti per $^1/_5$-$^1/_3$. Stamina, superiora 4 filamentis 1-2.5 mm longis (rarim longioribus), filamentum quinti staminis 2-3.5 mm longum, omnia filamenta in corolla inserta in parte superiore tubi. Capsula dehiscens septicide-septifrage in 2 valvis solum. Testa seminis favosa.

Corolla tube up to 1.5 mm wide at top of calyx; *corolla lobes* narrow (always longer

than broad), acute or narrowly obtuse, fused for $^1/_5$-$^1/_3$ their length. *Filaments* of upper 4 stamens 1-2.5 mm long (rarely longer), of fifth 2-3.5 mm long, all inserted onto corolla in distal $^1/_2$ of tube. *Capsule* splitting septicidally-septifragally only, into 2 valves. *Seed testa* honeycombed. (Figs. 4d, 5b).

Chromosome number: n = 24 (from meiotic pollen mother cells; voucher: plants [ADW 54171] cultivated from seed of *C.R. Dunlop 5028*).

Distribution and habitat

This subspecies is known only from the Daly River and Reynolds River region in north-western Northern Territory (Fig. 14). From the four field collections of *N. debneyi* subsp. *monoschizocarpa*, it appears that this subspecies grows in clay soils on riverbanks.

Fig. 5. (a) *Nicotiana debneyi* subsp. *debneyi*, voucher *R.W. Johnson 2814* (CANB); (b) *N. debneyi* subsp. *monoschizocarpa*, voucher *C.R. Dunlop 5028* (ADW).

Specimens seen (all cited)

NORTHERN TERRITORY: *C.R. Dunlop 3079*, Reynolds River (13°23'S, 130°46'E), 18.ix.1973 (ADW, DNA n.v.); *5028*, Daly River crossing (13°46'S, 130°42'E), 27.ix.1978 (ADW, DNA n.v.); *J. Muspratt 92*, Oolloo Station, Daly River banks, 25.ix.1962 (CANB, NT); plants cultivated at Waite Institute from seed ex *C.R. Dunlop 5028* (details above), 14.iii. & 12.iv.1979 (ADW 54171 & 54172).

2. **N. cavicola** N.T. Burbidge, Aust. J. Bot. 8:354, fig. 7, pl. 11 fig. 2 (1960).

Type: Glasshouse plant, 9.ii.1958, grown from sample *T.S.202*, the original seed collected *N.T. Burbidge 4774*, 7 miles east of Meekatharra, W.Aust., 11.xii.1955 (CANB 79168, lecto., here proposed).

Herb to 0.7(-1.0)m high, with 1-4 (or occasionally more) leafy stems. *Indumentum* moderately dense, of glandular trichomes which are often elongate at base of plant and are ellipsoid-headed on distal parts. *Leaves* both radical and cauline, petiolate; *lamina* (1-)2.5-14(-20)cm long x (0.5-)1-12.5cm wide, broad-ovate-deltate or broad-cordiform, becoming narrowly so above; apex obtuse or acute on basal leaves, becoming acuminate or elongate-acuminate on more distal leaves; base cordate, obtuse or cuneate; margin sinuate or undulate, often denticulate; *petiole* to 7.5(-11)cm long, broadly winged and occasionally slightly auriculate at the base, insertion onto stem simple to somewhat stem-clasping. *Inflorescence* an elongate, few-branched panicle, occupying up to $^2/_3$ the length of stems; *bracts* 4-45(-70)mm long, lanceolate to linear, the lower ones leafy; *pedicels* to 26mm long in fruit. *Calyx* 7-20(-26)mm long; sepals lanceolate to linear-lanceolate, subequal to unequal, fused for $^1/_3$-$^2/_3$ their length; intersepalar membranes inconspicuous. *Corolla tube* (18-)22-45(-50)mm long, 1-3(-3.5)mm wide at top of calyx; tube proper not distinct from throat cylinder; throat cup not very distinct, slightly asymmetrical; *corolla limb* 10-35(-40)mm diameter, closing in sunlight, lobes obtuse or occasionally narrow-obtuse (rarely slightly emarginate), fused for ($^1/_3$-)$^1/_2$-$^2/_3$ their length. Upper 4 *stamens* level or slightly subdidynamous, in throat cup, fifth stamen usually between the 2 of the longer pair; *filaments* of upper 4 stamens (0.4-)1-2.5(-5)mm long, of fifth (0.8-)3.5-6.5(-14)mm long and inserted onto corolla usually in distal $^1/_2$ of tube, occasionally below the middle. *Capsule* 6-12mm long, usually shorter than calyx, ovoid to ellipsoid or broadly so (length:breadth 2:1 to 3:2). *Seeds* (0.5-)0.6-0.9(-1.0)mm long, reniform or triangular- to oblong-reniform; testa with minutely-wavy-edged honeycombs. (Fig. 6a).

Chromosome number: n = 23 (Burbidge, 1960:356), n = 20 (Williams, 1975).

Distribution and habitat

N. cavicola occurs over the area between the Gascoyne River, Wiluna, Leonora and Rothsay in mid-western Western Australia (Fig. 15), and grows in sheltered areas amongst rocks on cliffs and breakaways.

Notes

Two sheets of sample *T.S.202* were present in the type folder of *N. cavicola*, neither annotated as a type by Burbidge. One sheet (CANB 79168) bears the date: 9.ii.1958, and the other (CANB 79167): 9.v.1958. In her revision, Burbidge (1960) did not refer to a specific sheet as being the type, nor did she give a date on which the cultivated type specimen was harvested. I therefore propose that the specimen with the earlier date be the lectotype, viz.: CANB 79168, coll. 9.ii.1958.

Selected specimens (total seen about 70)

WESTERN AUSTRALIA: *T.E.H. Aplin 2528*, 87km N.W. of Cue, on road to Mileura Homestead, 25.viii.1963 (ADW, PERTH); *A.M. Ashby 2614*, in rocks at Anketell Station, a mile or two south of the homestead, 13.ix.1968 (AD); *R.J. Chinnock 1027*, Nowthanna Hill, 50km S.S.E. of Meekatharra on Sandstone road, 14.ix.1973 (AD); *C.A. Gardner s.n.*, Wannarra, Aug. 1959 (PERTH); *7797*, Mt Magnet, S.E. side, 11.x.1945 (PERTH); *12035*, Ninghan, 17.viii.1953 (PERTH); *A.S. George 2741*, Niagara, 21.viii.1961 (PERTH); *2838*, Beeda Rockhole, 23.viii.1961 (PERTH); *4491*, 16km east of Laverton, 29.vi.1963 (PERTH);

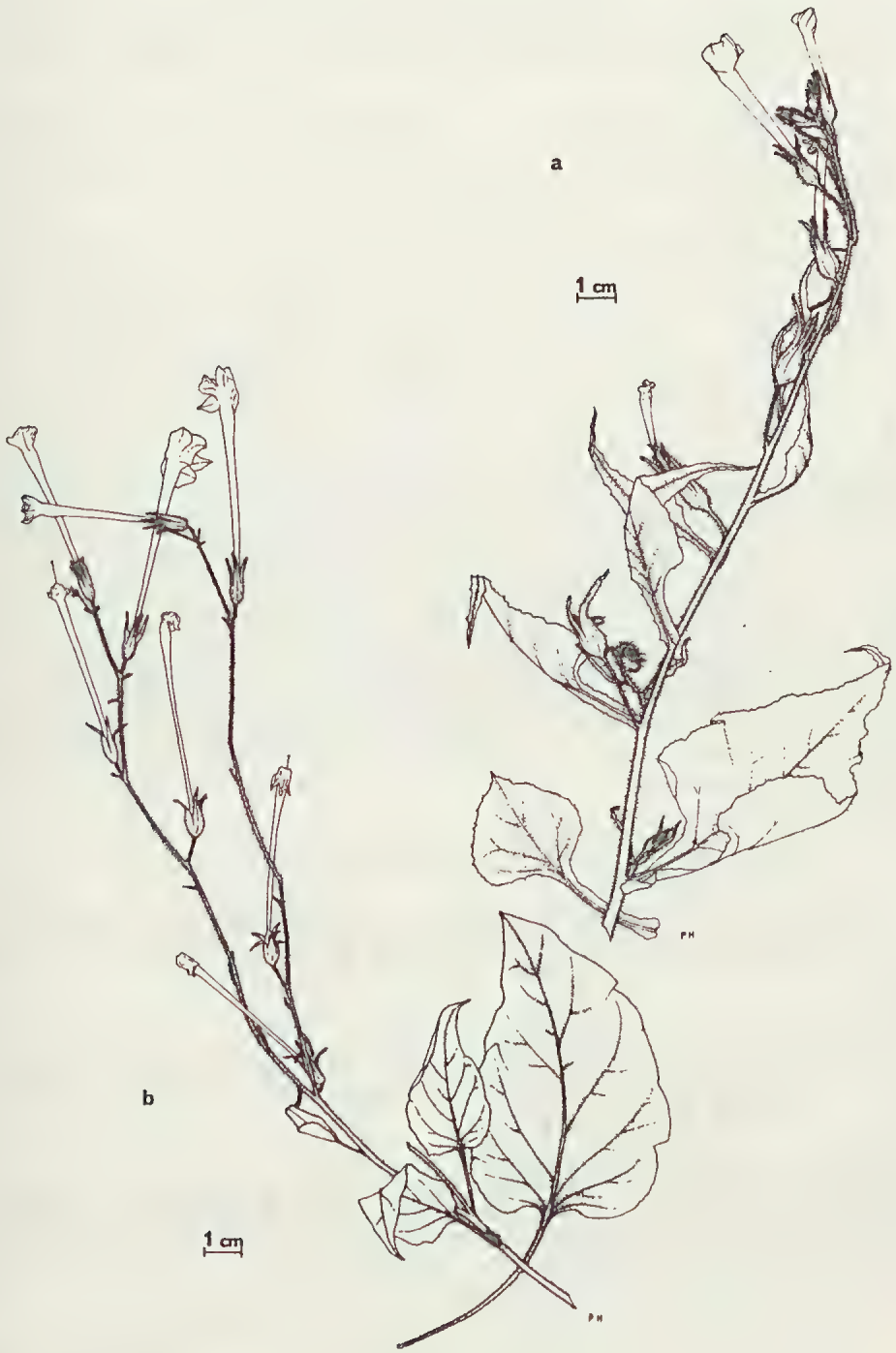


Fig. 6. (a) *Nicotiana cavicola*, voucher *R.D. Pearce 112* (ADW); (b) *N. umbratica*, voucher *N.T. Burbidge T.S. 302* (CANB).

5645, 72km S.W. of Wiluna, 29.vii.1963 (PERTH); *D. Hardy s.n.*, breakaway 14km north of Thundellara Homestead, 13.vii.1966 (PERTH); *R.D. Pearce 112*, north end of Lake Weelhamby, 30.viii.1977 (ADW). *J. Robertson s.n.*, Lake Austin, 1894 (MEL); *N.H. Speck 996A*, 16km west of Mileura on Nookawarra road, 17.ix.1958 (BRI, CANB, MEL); *D.E. Symon 5458*, about rocky breakaway 77km N.E. of Perrin Vale on road to Sandstone, 5.vii.1967 (ADW, CANB); *9949*, 95km south of Wiluna, 13.v.1975 (ADW).

3. **N. umbratica** N.T. Burbidge, Aust. J. Bot. 8:352, fig. 6, pl. 11, fig. 1 (1960).

Type: *E.H.M. Ealey E161*, Woodstock Station, Pilbara District, W. Aust., received Canberra May 1958 (CANB, holo.; K-photo. in ADW).

Herb to about 0.7m high, with ?1 main stem, leafy below inflorescence. *Indumentum* sparse to dense, of glandular trichomes, globular-headed near base of plant, becoming ellipsoid-headed on more distal parts. *Leaves* mostly cauline, petiolate; *lamina* (0.7-) 2.5-12cm long x (0.1-)1.5-10cm wide, broad-cordiform or ovate-deltate, becoming narrower above to narrow-ovate or occasionally lanceolate to linear; apex usually acuminate and often elongate, or may be obtuse on basal leaves; base cordate, becoming obtuse or occasionally acute above (rarely acuminate); margin entire to sinuate; *petiole* to 11cm long, very narrowly winged to almost terete, insertion onto stem simple. *Inflorescence* an elongate, few-branched panicle, occupying up to $^1/_2$ the length of stems; *bracts* 2-20(-35)mm long, linear or occasionally linear-lanceolate to lanceolate; *pedicels* to 16mm long in fruit. *Calyx* (6-)8-13(-15)mm long; sepals lanceolate, equal or subequal, fused for ($^1/_3$-)$^2/_5$-$^3/_5$ their length; intersepalar membranes inconspicuous. *Corolla tube* (25-) 40-66mm long, 1-2.5mm wide at top of calyx; tube proper not distinct from throat cylinder; throat cup usually indistinct, symmetrical; *corolla limb* 20-35mm diameter, closing in sunlight, lobes acute or occasionally narrowly obtuse, fused for $^1/_4$-$^1/_2$ their length. Upper 4 *stamens* usually slightly subdidynamous, in throat cup, the fifth between the two of the longer pair; *filaments* of upper 4 stamens 1.5-2.5mm long, of fifth 2-7mm long and inserted onto corolla in distal $^1/_2$ of tube. *Capsule* 6-10mm long, shorter than or equalling calyx, ovoid-ellipsoid (length:breadth [5:2-]2:1[-3:2]). *Seeds* 0.5-0.7mm long, oblong- or trapezoid-reniform; testa irregularly honeycombed or with sharp-edged wrinkles. (Fig. 6b).

Chromosome number: n = 23 (Burbidge, 1960:354).

Distribution and habitat

N. umbratica has a restricted range in the western part of the Pilbara district in north-western Western Australia (Fig. 15). It grows amongst rocky outcrops in the shelter of boulders.

Notes

Morphologically, *N. umbratica* appears to be closely related to *N. cavicola*, from which it can readily be distinguished by its almost terete petioles as opposed to the broadly winged petioles of the latter.

Selected specimens (total seen about 21)

WESTERN AUSTRALIA: *N.T. Burbidge 1048*, Dingo Point, Talga River, Eginbah Station, 8.vi.1941 (PERTH); *5820*, Ram Granite, Woodstock Station, 23.iv.1958 (AD, CANB, MEL); *5873*, Abydos Station, 26.iv.1958 (CANB, PERTH); *5957*, Hilliers Granite, Woodstock Station, 30.iv.1958 (CANB); *H. Suijdendorp 117*, Woodstock Station, *s.dat.* (PERTH).

4. **N. occidentalis** Wheeler, Univ. Calif. Publ. Bot. 18:52 (1935).

Type: *E. Mjöberg s.n.*, Port Hedland, W. Aust., 11.viii.1911 (NSW 47226, holo.).

Herb to 0.7(-1.3)m high, with 1 to several (up to 6) leafy stems. *Indumentum* a dense pubescence of sticky, ellipsoid-headed glandular hairs (usually a few simple glandular hairs present at base of plant). *Leaves* both radical and cauline, basal ones petiolate,

others soon becoming sessile above; *lamina* (1-)2-14(-20)cm long x 0.5-6(-9)cm wide, elliptic or narrowly so, becoming elliptic- or ovate-pandurate or narrowly so above, finally lanceolate or occasionally linear; apex obtuse or acute on basal leaves, becoming narrower above, to acuminate; base of basal leaves continuous with petiole, of more distal leaves auriculate and somewhat stem-clasping; margin entire to sinuate; *petiole* to 5(-16)cm long, broadly winged, insertion onto stem usually slightly stem-clasping. *Inflorescence* an elongate, few-branched panicle, occupying up to $^1/_2$ the length of stems or occasionally more, to almost all of stems, leafy in lower part; *bracts* (2-)4-50 mm long, often lanceolate or narrow-ovate and auriculate at base of inflorescence, becoming narrower more distally to linear-lanceolate or linear, usually leafy in lower part of inflorescence; *pedicels* to 28(-40)mm long in fruit. *Calyx* (5-)7-14 mm long; sepals lanceolate to linear-lanceolate, equal or subequal, fused for $^1/_2$-$^3/_4$(-$^5/_6$) their length; intersepalar membranes usually inconspicuous. *Corolla limb* 10-25 mm diameter, closing in sunlight, lobes emarginate, fused for $^1/_4$-$^4/_5$ their length. *Filaments* of upper 4 stamens 1-5 mm long. *Capsule* 7-14 mm long, equalling calyx or slightly shorter or longer, ovoid to ellipsoid or narrowly so (length:breadth 2:1 to 5:2, rarely to 7:2).

Notes

N. occidentalis, particularly subsp. *obliqua*, has a strong tendency to produce cleistogamous flowers, in which the corolla is much narrowed and shortened and may even be shorter than the calyx at maturity. A wide range in corolla tube length of chasmogamous flowers occurs in subsp. *obliqua*, the tube usually being either short (about 20 mm or less) or long (about 25 mm or more), with occasional specimens between 20 and 25 mm. There appears to be no correlation between tube length and habitat (as given in herbarium labels), geographical distribution, or physical state of the plant. In shorter flowers, the stamens tend to become level and the throat cup symmetrical, although occasional short-flowered specimens occur with a distinctly asymmetrical throat cup and strong subdidynamy of stamens.

Subsp. **occidentalis**

Corolla tube (26-)34-48(-52) mm long, (1-)1.5-2.5(-4) mm wide at top of calyx, tube proper not distinct from throat cylinder; throat cup indistinct to moderately distinct, symmetrical. Upper 4 *stamens* level, in throat cup; *filament* of fifth stamen 3-8 mm long and inserted onto corolla in distal $^1/_2$ of tube. *Seeds* 0.6-0.9 mm long, acutely angled or reniform or occasionally C-shaped, testa irregularly honeycombed or wrinkled, the wrinkles occasionally transversely aligned across the seed. (Fig. 7a).

Chromosome number: unknown? Goodspeed (1954:479) gave a haploid number of 21 for *N. occidentalis*, but referred to only one specimen as having this number, and this in fact is *N. occidentalis* subsp. *obliqua*. Burbidge (1960:347) listed *N. occidentalis* subsp. *occidentalis* with taxa having a haploid number of 21.

Distribution and habitat

N. occidentalis subsp. *occidentalis* has a restricted range in Western Australia along the coast and on offshore islands from Port Hedland south to the Exmouth Gulf (Fig. 16). Burbidge (1960) indicated that its range extended considerably further south, but most of the specimens I have seen from this region are subsp. *obliqua* or subsp. *hesperis*. It grows in sandy or rocky areas, often along creeklines or in the shelter of boulders or trees.

Selected specimens (total seen about 46)

WESTERN AUSTRALIA: *A.M. Ashby 2943*, North-West Coastal Highway, north of Minilya River, 16.viii.1969 (AD); *J.S. Beard 2876*, Wittenoom Gorge, 18.viii.1963 (PERTH); *A.C. Beauglehole 11567*, Point Samson, 17.viii.1965 (Beauglehole Herbarium); *N.T. Burbidge 1077*, Yandicoogina Creek, Mount Edgar Station, 10.vi.1941 (PERTH); *W.H. Butler 22*, Barrow Island, 18.viii.1973 (PERTH); *R.C. Carolin 7742*, Fig Tree Well, Yampire Gorge, 8.viii.1970 (SYD); *7881*, north of Karratha, Nickol Bay, 12.viii.1970 (PERTH,

SYD): *H. Demarz 4823*, 8 km south of Bullara Station turn-off, 3.xi.1973 (PERTH); *A.S. George 1149*, 16 km south of Onslow, 28.viii.1960 (PERTH); *1293*, 14 km north of Learmouth, 30.viii.1960 (PERTH); *2495*, Cape Range, road to Number 3 & 4 Wells, 2.vi.1961 (PERTH); *6605*, ca 8 km south of Exmouth township, 25.v.1968 (PERTH); *D.W. Goodall 629*, Ashburton Island, 5.viii.1963 (PERTH); *Hill s.n.*, Trimouille Island, 10.xi.1953 (CANB 28977).

Fig. 7. (a) *Nicotiana occidentalis* subsp. *occidentalis*, voucher *D.W. Goodall 629* (PERTH); (b) *N. occidentalis* subsp. *obliqua*, voucher *P. Horton s.n.* (ADW 53711), cultiv. from seeds of *A.C. Beauglehole 59571*; (c) *N. occidentalis* subsp. *hesperis*, voucher *T.E.H. Aplin 3207* (PERTH).

Subsp. **obliqua** N.T. Burbidge, Aust. J. Bot. 8:364, pl. 8 fig. 2 (1960).

Type: *R. Helms s.n.*, Victoria Desert, Camp 53, W. Aust., 15.ix.1891 (NSW 47228, holo.; AD 97433234 & 97433241; MEL *s.n.*).

N. occidentalis Wheeler (pro parte: *R. Helms s.n.*, Greenough, W. Aust., Oct. 1898 [NSW 47227, PERTH *s.n.*]).

Corolla tube 15-36(-40) mm long, (1-)1.5-3(-4) mm wide at top of calyx; tube proper not distinct from throat cylinder; throat cup not very distinct, symmetrical to strongly asymmetrical. Upper 4 *stamens* level to subdidynamous, in throat cup, or if subdidynamous then occasionally the longer pair or both pairs slightly exserted; if upper 4 stamens subdidynamous, the fifth between the 2 of the shorter pair; *filament* of fifth stamen 3.5-6 mm long and inserted onto corolla in distal $^1/_2$ of tube or about half way down. *Seeds* 0.6-0.9 mm long, acutely angled or reniform or occasionally C-shaped; testa irregularly honeycombed or wrinkled, the wrinkles occasionally transversely aligned across the seed. (Fig. 7b).

Chromosome number: n = 21 (Burbidge, 1960:348).

Distribution and habitat

N. occidentalis subsp. *obliqua* extends from near the coast in mid-western Western Australia to southern Northern Territory and scattered through most of the drier regions of South Australia, with one collection from western Queensland and one from south western New South Wales (Fig. 16). It grows in sandy or rocky areas, often along creeklines or in the shelter of boulders or trees.

Selected specimens (total seen about 226)

WESTERN AUSTRALIA: *T.E.H. Aplin 3295*, Monkey Mia, 10.vii.1970 (PERTH); *H. Demarz 4427*, 8 km south of Hamersley Station, 26.viii.1973 (PERTH); *A.S. George 5292*, Winburn Rocks, 22.vii.1963 (PERTH); *9016*, 11 km west of Dovers Hills, 27.vii.1967 (PERTH); *P.K. Latz 954*, ca 45 km S.S.W. of Docker River Settlement, 4.xi.1970 (CANB, NT); *R. Melville 4058*, Mt Magnetic, by Lake Yindarlgooda, 12.vii.1953 (AD, BRI, MEL, NSW, PERTH); *R.D. Royce 2001*, Mibbeyean Creek, 10.vi.1947 (PERTH).

NORTHERN TERRITORY: *G. Chippendale s.n.*, Charlotte Waters, 6.vii.1955 (NSW 48696); *P.K. Latz 4104*, Henbury Station, 23.viii.1973 (AD, CANB, NT); *4188*, Dean Range, 26.viii.1973 (AD, NT); *5063*, Mt Fraser, 29.iv.1974 (ADW, NT); *D.J. Nelson 2213*, Emily Gap, 6.vi.1972 (ADW, CANB).

QUEENSLAND: *S.L. Everist 3318*, Headingly Station, 2.xii.1947 (BRI, CANB).

NEW SOUTH WALES: *G.M. Cunningham 3381*, South Muluru Station, 15.iv.1975 (NSW).

SOUTH AUSTRALIA: *A.S. George 5165*, Cave Hill, 20.vii.1963 (PERTH): *L. Haegi 1283*, ca 2 km S.W. of Pondana Dam, 23.viii.1977 (ADW); *P. Horton 196*, hillside just north of the Peake Telegraph Repeater Station, 5.x.1978 (ADW); *T.R.N. Lothian 647*, ca 8 km W.N.W. of Cordillo Downs Homestead, 29.viii.1960 (AD); *5544*, Maralinga Village, 15.vii.1972 (AD); *D.E. Symon 6071*, Paralana Springs, 24.viii.1968 (ADW).

Subsp. **hesperis** (N.T. Burbidge) P. Horton, comb. nov.

Type: *N.T. Burbidge 6494A*, Rocky Pool, Gascoyne River, 35 miles east of Carnarvon, W. Aust., 3.ix.1959 (CANB, holo.; K-photo. in ADW).

N. occidentalis Wheeler (pro parte: *F.S. Carey s.n.*, near Roebourne, W. Aust., Aug. 1884 [MEL s.n.]).

N. hesperis N.T. Burbidge, Aust. J. Bot. 8:361, fig. 9, pl. 15 (1960), basionym.

Corolla tube 11-18 mm long, 1.5-3 mm wide at top of calyx; tube proper slightly narrower than throat cylinder; throat cup indistinct, symmetrical. Upper 4 *stamens* level, in throat cup; *filament* of fifth stamen 3.5-7 mm long and inserted onto corolla in proximal $^1/_2$ of tube or about half way down. *Seeds* 0.5-0.8 mm long, C-shaped or usually bent into a U-shape, occasionally crested along outer surface; testa wrinkled, the wrinkles long and aligned transversely across the seed. (Figs. 3, 7c).

Chromosome number: unknown? Burbidge (1960:361) stated that the chromosome number was unknown, but again listed it elsewhere (p. 347) with taxa having a haploid number of 21.

Distribution and habitat

This subspecies occurs in Western Australia, mainly along the coast and on offshore islands from the Minilya River south to about mid-way between Geraldton and Perth, with one collection further north from near Roebourne and one well inland, near Leonora (Fig. 16). It grows in sandy or rocky areas, often along creeklines or in the shelter of boulders or trees.

Notes

The only reasonably consistent feature distinguishing *N. hesperis* from *N. occidentalis* was found to be the nature of the seeds, without which it is impossible to separate with any confidence the former from short-flowered *N. occidentalis* subsp. *obliqua* with level stamens. Occasional specimens of subspecies *obliqua* and *occidentalis* (either within or outside the range of *N. hesperis*) possess seeds which are reminiscent of those of *N. hesperis*, particularly in the transverse alignment of wrinkles across the testa; e.g. *T.E.H. Aplin B1*, Boolathana Station, W. Aust. 5.xi.1963 (AD, ADW, PERTH); *D.G. Wilcox s.n.*, Mt Augustus Station, W. Aust., 7.vii.1970 (PERTH). The seeds of *N. hesperis* are themselves dramatically variable, in the presence or absence of a crest. For these reasons, therefore, it was felt that *N. hesperis* is not sufficiently distinct and that its distinctive features are not sufficiently stable to justify specific rank. It is therefore here reduced to a subspecies of *N. occidentalis*. The crested nature of the seeds of some specimens of *N. occidentalis* subsp. *hesperis* was not seen in any other Australian *Nicotiana*; it does not appear to be correlated with any other morphological features and may be present or absent within the one population.

Selected specimens (total seen about 42)

WESTERN AUSTRALIA: *T.E.H. Aplin 2296*, 16 km south of Leonora on Menzies road, 17.viii.1963 (ADW, PERTH); *N.T. Burbidge 6445*, 74 km north of Murchison River bridge on Carnarvon road, 1.ix.1959 (CANB); *6455*, near Woodleigh Station Homestead, 2.ix.1959 (BRI, CANB, MEL, NSW); *6480*, Wooramel River Bridge, Carnarvon road, 2.ix.1959 (CANB); *6519*, between Greenough and Dongara, 5.ix.1959 (AD, BRI, CANB, MEL); *W.H. Butler s.n.*, Monkey Mia, Aug. 1957 (PERTH); *R.C. Carolin 3257*, shores of Lharidon Bight, 26.viii.1961 (SYD); *A.S. George 11386*, ca 8 km south of homestead, Dirk Hartog Island, 2.ix.1972 (PERTH); *R.D. Royce 6014*, Bernier Island, 23.vii.1959 (PERTH); *G.M. Storr s.n.*, North Island, Houtman Abrolhos, 6.ix.1959 (PERTH); *s.n.*, 19 km north of Jurien Bay, 22.x.1961 (PERTH 5758/61).

5. **N. benthamiana** Domin, Biblioth. Bot. 89:1145, pl. 37 fig. 1 (1929).

Type: *Bynoe s.n.*, N.W. coast, Australia, *s. dat.* (collected on the voyage of HMS "Beagle", 1839-40, under command of Capts Wickham & Stokes (K-photo. in ADW, holo.).

N. suaveolens var. *cordifolia* Benth., Fl. Austral. 4:470 (1868).

Type: as for *N. benthamiana*.

Leafy herb to 0.6(-1.5) m high, with one or a few leafy stems often branched near the base. *Indumentum* on all parts a moderately dense pubescence of glandular trichomes. *Leaves* mostly cauline, basal ones petiolate, more distal ones soon becoming subsessile to sessile; *lamina* (0.7-) 1.5-14 (-23) cm long x (0.3-) 1-9 (-15) cm wide, broad-ovate (occasionally suborbicular) to narrow-ovate (occasionally narrow-elliptic) above; apex obtuse on basal leaves, becoming acute and often acuminate on most distal leaves (occasionally elongate-acuminate); base obtuse or cuneate (occasionally shallowly cordate); margin entire or slightly sinuate or denticulate; *petiole* to 6 cm long, moderately broadly to narrowly winged, insertion onto stem simple or occasionally slightly stem-clasping. *Inflorescence* of solitary, interfoliar flowers distributed along most of the length of stems; *pedicels* to 15 mm long in fruit. *Calyx* (5-)8-17 mm long; sepals linear-lanceolate to lanceolate or narrow-elliptic, subequal to unequal, fused for $^1/_3$-$^1/_2$(-$^3/_5$) their length, the distal portions usually loose and spreading or recurved; intersepalar membranes

inconspicuous. *Corolla tube* (19-)24-55(-60) mm long, up to 2(-2.5) mm wide at top of calyx; tube proper not distinct from throat cylinder; throat cup not very distinct, symmetrical or slightly asymmetrical; *corolla limb* (7-)10-21 mm diameter, closing in sunlight, lobes obtuse to slightly emarginate (occasionally narrow-obtuse to broad-acute), fused for $^1/_3$-$^3/_4$ their length. Upper 4 *stamens* usually slightly subdidynamous, in throat cup, fifth stamen usually between the 2 of the longer pair; *filaments* of upper 4 stamens 0.3-2.5 mm long, of fifth 5-10 mm long and inserted onto corolla in distal $^1/_2$ of tube. *Capsule* 6-11(-13) mm long, shorter than or occasionally equalling calyx, ovoid to ellipsoid or broadly so (length:breadth 2:1 or 3:2, occasionally 1:1). *Seeds* 0.5-0.7 mm long, oblong- or trapezoid-reniform; testa with wavy-edged (rarely straight-edged) honeycombs to serpentine wrinkles. (Figs. 4g, 8a).

Chromosome number: n = 19 (Goodspeed, 1954:485).

Distribution and habitat

The distribution of *N. benthamiana* is patchy, and is widespread across the northern half of Australia from north-western Western Australia across the Northern Territory to western Queensland (Fig. 15). The species grows in sheltered areas amongst rocks or in caves on rocky slopes. It usually occurs on low rocky hills and outcrops, which may partly explain its apparently patchy distribution.

Notes

As noted by Burbidge (1960), two types of seed-coat ornamentation pattern can be seen in this species. In the majority of specimens the pattern is of wavy-edged honeycombs or wrinkles, but in four specimens: *N.T. Burbidge T.S. 299*, *K.F. Keneally 4181*, *M. Lazarides 6292* and *N.B. Tindale s.n.* (AD 97610338) (and apparently in the holotype [Burbidge, 1960]) the pattern is reticulate. These latter specimens all occur in the northern-most region of Western Australia.

N. benthamiana is not known to occur in South Australia, despite its presence in southern Northern Territory. There are two collections: *D.E. Symon 9294* and *9354*, which resemble *N. benthamiana* and are both from a population at Dalhousie Springs in the far north of South Australia. (An additional specimen, *D.E. Symon 9895*, was cultivated from seedlings from the same site). These specimens differ from *N. benthamiana* in that they are unusually succulent and sprawling, and the corolla is considerably larger (the tube 45-90 mm long and the limb usually more than 30 mm in diameter). Chromosome counts from meiotic pollen mother cells of plants grown at the Waite Institute indicate that the haploid number is probably 21, not 19 as in *N. benthamiana*. These collections may therefore represent a new species, but more detailed study would be desirable to establish this and to illuminate their relationship with *N. benthamiana*. A naturally-occurring hybrid between this Dalhousie Springs material and *N. velutina* is discussed in the section on hybrids.

N. benthamiana was one of the species highly prized by certain aborigines for chewing (Latz, 1974).

Selected specimens (total seen about 117)

WESTERN AUSTRALIA: *W.R. Barker 2078*, Oakover River, Upper Carawine Pool, 24.viii.1977 (AD); *J.V. Blockley 989*, 14 km N.E. of Wyloo Station, near Belvedere Mine, 27.ix.1968 (PERTH); *N.T. Burbidge 1191*, Mount Edgar Station, 13.vi.1941 (PERTH); *G.W. Carr 4284*, north end of Windjina Gorge, Napier Range, 27.viii.1974 (Beauglehole Herbarium); *4927*, Hancock Gorge, Hamersley Range National Park, 10.viii.1974 (Beauglehole Herbarium); *R.J. Chinnock 894*, 55.6 km S.E. of Glenayle Homestead on Carnegie to Glenayle Station road, 9.ix.1973 (AD); *Fisheries Department ?174*, Dolphin Island, Dampier Archipelago, 20.vi.1970 (PERTH); *A.S. George 8818*, Glen Cumming, Rawlinson Range, 21.vii.1967 (MEL, NT, PERTH); *8996*, Dovers Hills, northern Gibson Desert, 27.vii.1967 (PERTH); *R.A. Gould s.n.*, Picture Hill, 209 km N.W. of Well 35 (Canning Stock Route), 24.iv.1967 (PERTH); *K.F. Keneally 4181*, Craticus Falls, Drysdale River National Park, 10.viii.1975 (PERTH); *M. Lazarides 6292*, 11 km E.S.E. of Halls Creek township, 9.vii.1959 (AD, BRI, CANB, MEL, NSW, PERTH).

NORTHERN TERRITORY: *A.C. Beauglehole 50887*, The Granites, 19.v.1976 (Beauglehole Herbarium); *G. Chippendale s.n.*, near Alcoora Spring, Tobermorey Station, 10.x.1955 (BRI 32505, CANB 98167, NSW 60705, NT 1799); *N.M. Henry 792*, Seigal Creek area north of China Well, 1.vi.1973 (BRI, CANB, NT); *P.K. Latz 642*, Old Huckitta Homestead, 20.vii.1970 (NT); *2662*, Mount Doreen Station, 14.i.1972 (NT); *4187*, Dean Range, 26.viii.1973 (CANB, NT); *R.A. Perry 2269*, 64 km west of Wavehill Police Station, 27.vi.1949 (AD, BRI, CANB, NSW, NT).

QUEENSLAND: *S.T. Blake 11527*, Duchess, 18.v.1936 (BRI).

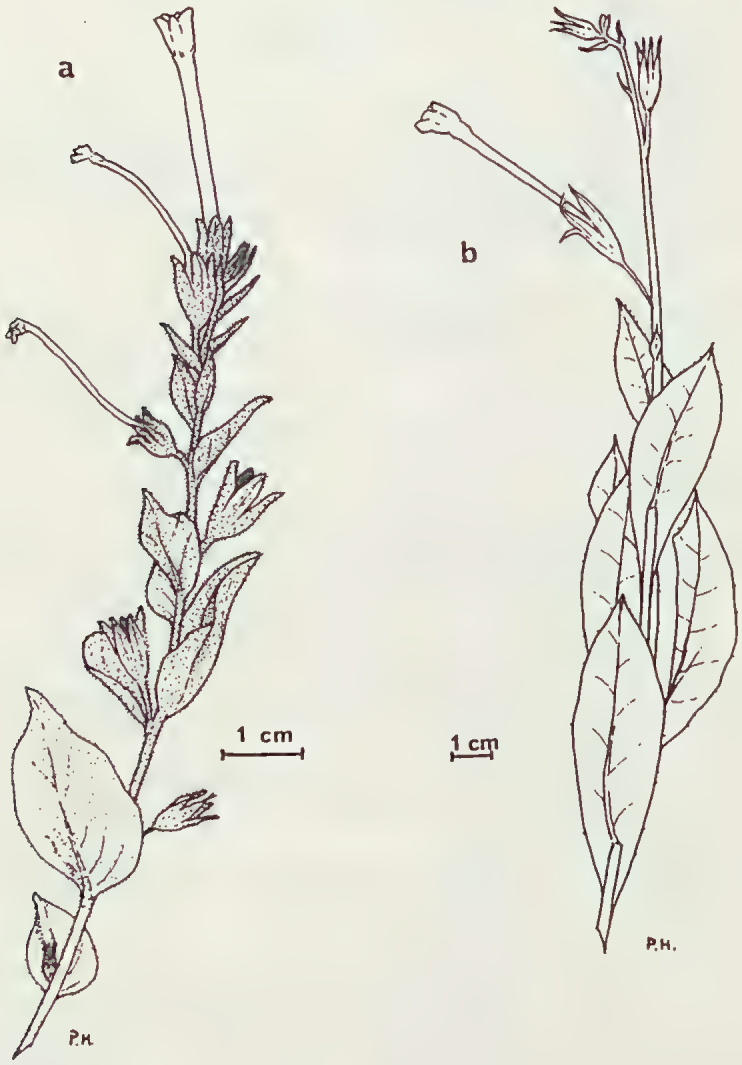


Fig. 8. (a) *Nicotiana benthamiana*, voucher *P. Horton s.n.* (ADW 51287), cultiv. from seeds of *P.K. Latz 6524*; (b) *N. excelsior*, voucher *D.E. Symon 3336* (ADW).

6. **N. excelsior** (J.M. Black) J.M. Black, Trans. R. Soc. S. Aust. 50:286 (1926).

Type: *S.A. White s.n.*, Mt Carminia (i.e. Carmeena), Everard Range, S. Aust., 12.viii.1914 (AD 97807202, lecto., here proposed; NSW 141364).

N. suaveolens var. *excelsior* J.M. Black, Trans. R. Soc. S. Aust. 39:835, pl. 63 fig. 2, pl. 70 (1915), basionym.

N. macrocalyx Domin, Biblioth. Bot. 89:1147, pl. 36 figs. 9-10 (1929).

Type: *R. Helms s.n.*, Elder Exploring Expedition Camp 19, Birksgate Range, S. Aust., 12.vii.1891 (K-photo. in ADW, holo.; AD; MEL; none held at PR).

Leafy herb to 1(-1.65)m high, with 1 leafy main stem (rarely more). *Indumentum* on bracts, pedicels and calyx of sparse eglandular trichomes with inflated cells, often tuberculate; stems and leaves glabrous, or a few tuberculate trichomes may be present on leaf margins. *Leaves* mostly cauline, basal ones shortly petiolate to subpetiolate, soon becoming sessile; *lamina* (1.5-)3-15(-25)cm long x (0.5-)1-8(-14)cm wide, elliptic or ovate or narrowly so (rarely broadly), the basal leaves often obovate, the most distal ones often narrow-elliptic or lanceolate; apex acuminate, acute or obtuse; base decurrent down stem (continuous with petiole on basal leaves); margin entire or slightly sinuate, occasionally denticulate due to scattered tuberculate trichomes; *petiole* broadly winged, insertion on stem decurrent, or stem-clasping if basal leaves. *Inflorescence* an elongate, few-branched panicle, occupying less than $^1/_2$ the length of stems (usually only the distal portions); *bracts* 2-19(-40)mm long, basal ones occasionally leafy; *pedicels* to 23 mm long in fruit. *Calyx* (13-)16-26(-32)mm long; sepals linear to linear-lanceolate, subequal to unequal, fused for ($^1/_4$-)$^1/_3$-$^3/_4$ their length; intersepalar membranes long but not particularly conspicuous. *Corolla tube* (27-)39-67(-80)mm long, (1-)2-4(-5)mm wide at top of calyx; tube proper not distinct from throat cylinder; throat cup indistinct, symmetrical or often slightly asymmetrical; *corolla limb* 20-35(-52)mm diameter, closing in sunlight, lobes obtuse (rarely slightly emarginate), fused for $^1/_3$-$^3/_4$ their length. Upper 4 *stamens* level or slightly subdidynamous, in throat cup or occasionally slightly exserted, fifth stamen between the 2 of the longer pair; *filaments* of upper 4 stamens 0.5-1.5(-2.5)mm long, of fifth 6.5-15 mm long and inserted onto corolla in middle or proximal $^1/_2$ of tube. *Capsule* 12-20 mm long, usually shorter than calyx (rarely slightly longer), ellipsoid to ovoid-ellipsoid (length:breadth 5:2 to 2:1). *Seeds* 0.8-1.3 mm long, reniform or acutely angled; testa honeycombed or occasionally with wavy-edged honeycombs (rarely almost wrinkled). (Fig. 8b).

Chromosome number: n = 19 (Goodspeed, 1954:469).

Distribution and habitat

This species is restricted to the range systems of north-western South Australia and southern Northern Territory, where it grows in rocky gullies and creeklines (Fig. 15). Two geographically anomalous specimens were collected well outside this area. One is a Robert Helms collection from the Fraser Range in southern Western Australia, 23.x.1891 (AD 97433242, no duplicates in other herbaria were found) and the other was collected by Max Koch at Mt Lyndhurst in mid-northern South Australia, Aug. 1899 (AD 97602103). If these were in fact collected at the stated localities, they might possibly represent populations established from material brought from elsewhere by aborigines, perhaps in trade with other aboriginal tribes. A collection made at Evelyn Downs, South Australia (*E.H. Ising s.n.*, 20.ix.1952, AD 97413288) is annotated ". . . said by natives Hector and Jerry not native of this place but coming from a long way N.W. (? Everard Range). Evidently grown from material obtained for chewing.", which indicates that this species is or was transported by aborigines from one area to another.

Notes

Type specimens of *N. excelsior* are held at both AD and NSW, and Black (1926) did not specify a particular specimen as the holotype. The NSW specimen lacks the numerous

notes and drawings of the AD specimen, and appears not to have been annotated by Black at all, so the AD specimen is here proposed as the lectotype.

N. excelsior is a large and attractive species, and one of the most favoured by aborigines for chewing (Latz, 1974). It is unusual amongst the Australian species in the strongly decurrent nature of its leaves (a condition occasionally found in robust specimens of *N. gossei*, but never to the extent as in *N. excelsior*).

Selected specimens (total seen about 125)

NORTHERN TERRITORY: *E. Giles s.n.*, Glen of Palms, *s. dat.* (MEL); *R.A. Gould s.n.*, Petermann Range at W.A.-N.T. border, 29.ix.1966 (PERTH); *P.K. Latz 894*, Mann Ranges, 48 km E.N.E. of Mt Davies Camp, 31.x.1970 (AD, CANB, NT); *7116*, Chewings Range, 26.v.1977 (ADW); *D.E. Symon s.n.*, Mt Olga, 12.vi.1953 (ADW 9669).

SOUTH AUSTRALIA: *A.C. Beauglehole 25480*, Everard Ranges, Mt Illbillee area, 27.vi.1968 (Beauglehole Herbarium); *J.B. Cleland s.n.*, Musgrave Range, rock-hole ca 13 km north of Ernabella, 16.viii.1933 (AD 95631001 & 95631002); *G.C. Cornwall 199*, Carmeena Rockhole, 35 km S.W. of Everard Park Homestead, 4.vi.1972 (AD); *N. Forde 902*, 16 km north of Everard Park Homestead, 5.ix.1957 (AD, NT); *914*, 64 km W.S.W. of Everard Park Homestead, 6.ix.1957 (NT); *R. Helms s.n.*, Birksgate Range, 12.vii.1891 (AD 97433244 & 97809249, K *s.n.*); *R.H. Kuchel 422*, 6 km west of Mt Woodroffe, 11.viii.1962 (AD); *D.E. Symon 2562*, Mt Lindsay, 6.viii.1962 (AD); *3336*, creekline near Victory Well, Everard Ranges, 16.ii.1965 (ADW, CANB); *F.T. Turvey s.n.*, Ernabella, 21.v.1966 (AD 97628362); *D.J.E. Whibley 1122*, Amoorinyinna Hill, 13.ix.1963 (AD); *Woskett s.n.*, Oodnadatta, 14.x.1955 (AD 97413289).

7. **N. amplexicaulis** N.T. Burbidge, Aust. J. Bot. 8:359, fig. 8, pl. 13 fig. 1 (1960).

Type: *N.T. Burbidge 5562*, Carnarvon Range, 63 miles south of Rolleston, Queensland, 13.ix.1956 (CANB, holo.; AD; K-photo. in ADW; MEL; NSW).

Herb to 1(-1.3) m high, with 1 or a few leafy stems. *Indumentum* on all parts a soft, dense pubescence of eglandular trichomes. *Leaves* mostly cauline, sessile except for the petiolate ones near the base; *lamina* (1-)2-22(-30) cm long x (0.5-)1-12(-19) cm wide, elliptic or broadly so, becoming pandurate above, to narrow-elliptic or lanceolate and auriculate at base of inflorescence; apex obtuse on basal leaves, becoming acute, to acuminate on most distal leaves; base obtuse or cuneate on basal leaves, to auriculate on most distal leaves; margin entire to sinuate; *petiole* to 5(-8) cm long, broadly winged, somewhat stem-clasping and auriculate at the base. *Inflorescence* an elongate, few-branched panicle, occupying less than half the length of stems; *bracts* 3-15(-35) mm long, lanceolate to linear-lanceolate, occasionally the lowermost broader and more foliose; *pedicels* to 18 mm long in fruit. *Calyx* 7-11(-14) mm long; sepals lanceolate, equal to unequal, fused for half their length; intersepalar membranes inconspicuous. *Corolla tube* 15-20 mm long, 2-3(-3.5) mm wide at top of calyx; tube proper distinctly narrower than throat cylinder; throat cup indistinct, symmetrical; *corolla limb* 6-12.5 mm diameter, closing in sunlight, lobes obtuse to emarginate, fused for half to almost all their length. Upper 4 *stamens* usually slightly subdidynamous, rarely equal, in throat cup or the longer pair slightly exserted, fifth stamen between the 2 of the longer pair; *filaments* of upper 4 stamens 0.5-2.5 mm long, of fifth 8-11 mm long and inserted onto corolla in proximal half of tube. *Capsule* (5-)6-9 mm long, equalling or shorter than calyx (rarely slightly longer), ellipsoid to ovoid-ellipsoid or broadly so (length:breadth 2:1 to 3:2). *Seeds* 0.6-0.9 mm long, reniform or oblong-reniform or L-shaped; testa with short, round-edged wrinkles. (Fig. 9a).

Chromosome number: n = 18 (Burbidge, 1960:360)

Distribution and habitat

N. amplexicaulis is apparently restricted to the Carnarvon Range and nearby ranges to its east, in southern Queensland (Fig. 14). It grows in the shelter of rocks on sandstone cliffs and at cave entrances.

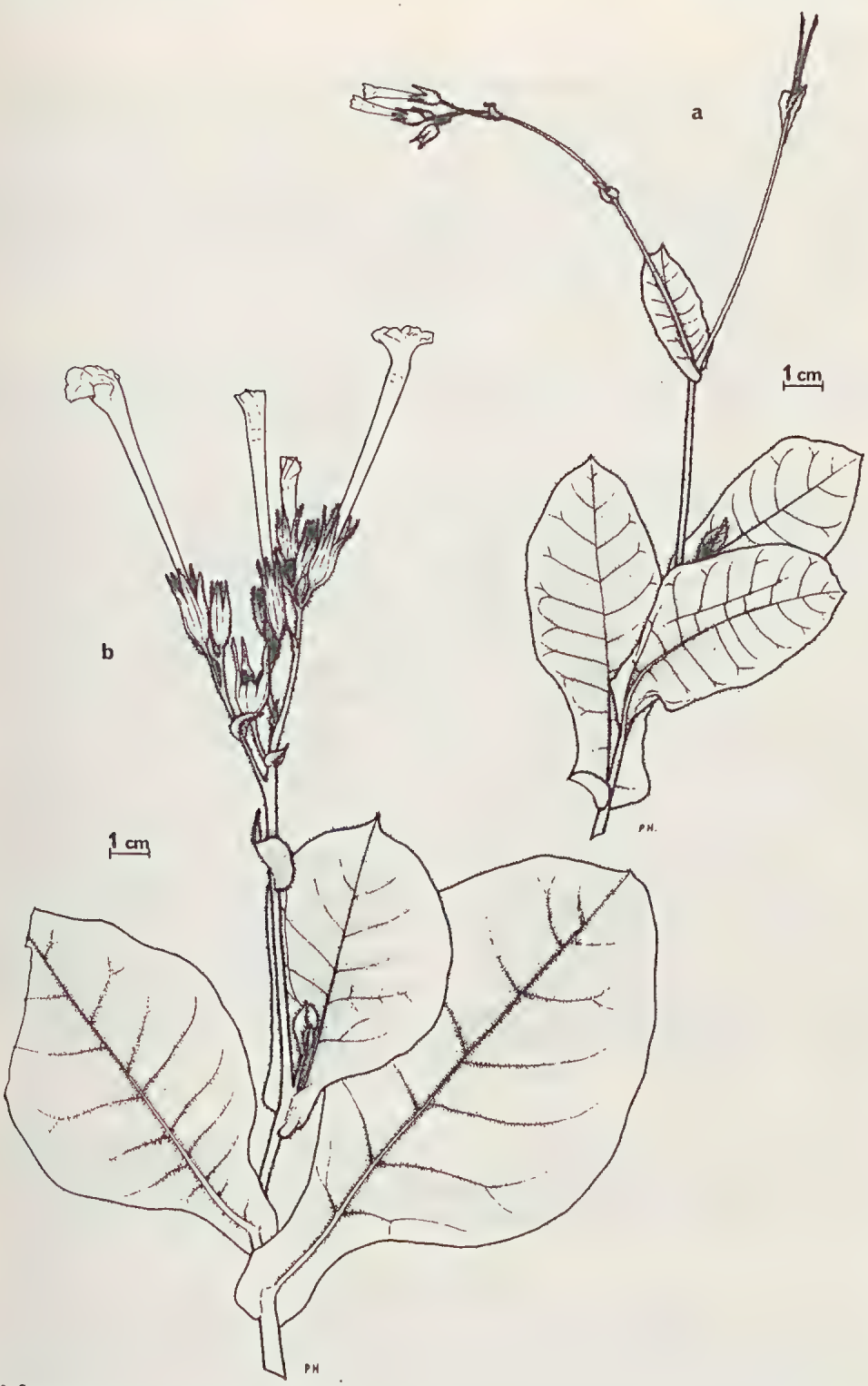


Fig. 9. (a) *Nicotiana amplexicaulis*, voucher *N.T. Burbidge T.S. 111* (CANB); (b) *N. gossei*, voucher *P.K. Latz s.n.* (NT 12077).

Notes

In morphology this species appears to be closely related to *N. gossei*. It differs from the latter in that the flowers are very much smaller and the plants generally less robust.

Specimens seen (all cited)

QUEENSLAND: *N.T. Burbidge 5560*, Carnarvon Range, 84 km south of Rolleston, 13.ix.1956 (AD, CANB, NSW); *T.S.111*, Dec. 1955, cultivated from seed coll. M.S. Stevens, Moolayember (BRI, CANB, K, MEL, NSW); *C.H. Gittins 369*, Carnarvon Range, Aug. 1960 (BRI); *F.D. Hockings 491*, Isla Gorge, ca 28 km S.W. of Theodore, 19.viii.1973 (BRI); *M. Olsen & N.B. Byrnes 3560*, Glenaughton-Mapala road, 26.v.1977 (BRI); *W.F. Snewen s.n.*, Moolayember Creek, 93 km north of Injune, March 1948 (BRI 239743); *M.S. Stevens s.n.*, Moolayember region, Dec. 1954 (BRI 230232, CANB 30345).

8. **N. gossei** Domin, Biblioth. Bot. 89:1146, pl. 36 figs. 2-5 (1929).

Type: *Gosse 243*, centre of South Australia (comm. R. Schomburgk, May 1874) (K-photo. in ADW, holo.? note: Goodspeed [1954:467] gave the type specimen as being held at MEL, but I found no specimen of the type collection there. No specimen is held at PR).

Leafy herb to 1(-2.1) m high, with 1 or a few leafy stems, often woody at the base. *Indumentum* on all parts a dense pubescence of eglandular and glandular trichomes, often woolly in appearance. *Leaves* mostly cauline, basal ones petiolate to subpetiolate, others sessile; *lamina* (1.5-)5-25(-35) cm long x (0.5-)2-12(-16) cm wide, broad-elliptic (occasionally obovate), becoming narrow-elliptic to lanceolate above and usually pandurate; apex usually obtuse on basal leaves, becoming acute, usually to acuminate on most distal leaves; base of cauline leaves auriculate and stem-clasping; margin entire to sinuate, occasionally undulate; *petiole* to 5(-8) cm long, broadly winged, auriculate and stem-clasping at the base. *Inflorescence* a few-branched panicle, usually occupying only distal portions of stems; *bracts* (3-)5-15(-50) mm long, linear to lanceolate, occasionally the basal ones leafy; *pedicels* to 17(-21) mm long in fruit. *Calyx* (12-)15-27(-31) mm long; sepals linear-lanceolate, occasionally linear (rarely lanceolate), subequal to unequal, fused for (1/4-)2/5-3/5 their length; intersepalar membranes inconspicuous. *Corolla tube* (26-)30-65(-77) mm long, (1-)2-4(-5) mm wide at top of calyx; tube proper not distinct from throat cylinder; throat cup usually indistinct, symmetrical or almost so; *corolla limb* 15-35 mm diameter, closing in sunlight, lobes obtuse or occasionally shallow-emarginate, fused for 1/2 their length. Upper 4 *stamens* level or almost so, in throat cup (rarely slightly exserted); *filaments* of upper 4 stamens 0.5-5.5 mm long, of fifth 2-15 mm long and inserted onto corolla in distal 1/2 of tube or to just below half way down. *Capsule* (8-)10-16 mm long, shorter than calyx, ellipsoid to ovoid (length:breadth 2:1 to 3:2). *Seeds* (0.6-)0.7-0.9(-1.0) mm long, acutely angled or reniform to oblong-reniform; testa irregularly honeycombed, or wrinkled. (Fig. 9b).

Chromosome number: n = 18 (Wheeler, 1935:54).

Distribution and habitat

N. gossei grows in pockets of fertile soil, often sandy, amongst rocks on the major range systems of southern Northern Territory and north-western South Australia (Fig. 14). It usually occurs high up on the main ranges, rather than on small rocky hillsides and outcrops where *N. benthamiana* can be found (P.K. Latz, pers. comm. 1979).

Notes

Burbidge (1960) noted that there was a group of unusually depauperate specimens from western Queensland; these are in fact *N. megalosiphon* subsp. *sessilifolia*, the cauline leaves of which characteristically have slightly auriculate bases, reminiscent of *N. gossei*.

N. gossei is another of the species much favoured by aborigines for use as a chewing tobacco. (Latz, 1974).

Selected specimens (total seen about 152)

NORTHERN TERRITORY: *A.C. Beauglehole 44974*, N'Dahla Gorge, 3.vi.1974 (Beauglehole Herbarium); *G.W. Carr 1521*, Ormiston Gorge, 9.vi.1974 (Beauglehole Herbarium); *2136*, Gosse Bluff, 26.vi.1974 (Beauglehole Herbarium); *P.K. Latz s.n.*, Ellery Gorge, 11.ii.1967 (NT); *355*, Kings Canyon, 12.xii.1968 (AD, MEL, NT); *778*, Serpentine Gorge, 7.ix.1970 (NT); *786*, Palm Valley, 28.ix.1970 (NT); *818*, Maggie Springs, Ayers Rock, 24.x.1970 (NT); *896*, Bloods Range, 42 km N.E. of Docker River Settlement, 29.x.1970 (NT); *1025*, Simpsons Gap, 23.xii.1970 (NT); *4215*, Longs Range, 28.viii.1973 (CANB, NT); *R. Pullen 10488*, hill of the Blatherskite Range near Stuart Highway, 25.iii.1977 (CANB); *D.E. Symon s.n.*, Mt Conner, 15.vi.1953 (ADW); *W.H. Tietkens s.n.*, Laura Vale, 1889 (AD).

SOUTH AUSTRALIA: *H. Haigh & L.D. Williams 6435*, Everard Range, near Pocket Well, Oct. 1974 (AD); *F.T. Turvey s.n.*, 64 km west of Ernabella, 15.viii.1966 (NSW 85271); *Wallace s.n.*, Musgrave Ranges, 26°17'S, 131°01'E, 12.viii.1973 (ADW 50056, NT 53589).

9. **N. megalosiphon** Heurck & Muell.-Arg. in Van Heurck, Obs. Bot. 126 (1870).

Type: "Habitat in Nova-Hollandia septentrionali ad Portum Curtis (hb. van Heurck, collector ignotus probabiliter Damell.)" (Daemel?) *s.dat.* (current locality not determined; no reply received from AWH to query as to possible location there).

Herb to 0.8(-0.9) m high, with 1 or 2 (rarely more) main stems. *Indumentum* on all parts a fairly dense pubescence of glandular trichomes. *Leaves* both radical and cauline or mostly radical; *lamina* (1-)3-12(-17) cm long x (0.1-)1-6(-9) cm wide, elliptic to ovate or narrowly so, to lanceolate above, often linear at base of inflorescence; apex obtuse or acute on basal leaves, becoming acute, to acuminate on most distal leaves; margin entire or occasionally slightly sinuate; *petiole* to 7(-9.5) cm long, narrowly winged, insertion on stem simple or slightly stem-clasping. *Inflorescence* an elongate, few-branched panicle, occupying up to $^1/_2(-^2/_3)$ the length of stems; *bracts* (1-)2-13(-27) mm long, linear to lanceolate; *pedicels* to 24(-30) mm long in fruit. *Calyx* 10-18(-21) mm long; sepals linear-lanceolate, subequal (rarely equal), fused for $(^2/_5-)^1/_2(-^3/_5)$ their length; intersepalar membranes long but inconspicuous. *Corolla tube* (34-)40-82(-93) mm long, 1-2(-2.5) mm wide at top of calyx; tube proper not distinct from throat cylinder; throat cup distinct in bud, not very distinct after anthesis, symmetrical or almost so; *corolla limb* (13-)18-30 (-35) mm diameter, closing in sunlight, lobes emarginate (rarely obtuse), fused for $^1/_3$ their length. Upper 4 *stamens* level or almost so, in throat cup; *filaments* of upper 4 stamens 0.5-2 mm long, of fifth 1.5-11 mm long and inserted onto corolla in distal $^1/_2$ of tube. *Capsule* 7-12(-16) mm long, shorter than calyx, ovoid-ellipsoid (length:breadth 2:1). *Seeds* 0.6-0.9(-1.0) mm long, reniform or acutely angled.

Notes

Depauperate specimens of this species may be confused with *N. simulans* in that the corolla tube is usually short and approaches that of *N. simulans* in length. Morphologically, these two species appear to be closely related.

Subsp. **megalosiphon**

Leaves petiolate or rarely the most distal ones sessile; lamina base obtuse or cuneate, often attenuate on most distal leaves. *Seed testa* irregularly honeycombed or usually wrinkled. (Figs. 4a, 10b).

Chromosome number: n = 20 (Wheeler, 1935:54).

Distribution and habitat

N. megalosiphon subsp. *megalosiphon* occurs in south-eastern and central Queensland, and in mid-northern to north-eastern New South Wales (Fig. 17), and grows in sandy to loam or clay soils in open areas in savannah or woodland, often in disturbed sites.

Selected specimens (total seen about 250)

QUEENSLAND: *Adams 1367*, 3km north of Glenlee Station, 13.x.1964 (BRI, CANB, NSW); *S.T. Blake 11652*, Oakley Station, 2.vi.1936 (BRI); *B.G. Briggs 1155*, Forest Park Station, 14.viii.1967 (NSW); *4292*, 3km east of Cracow on Eidsvold road, 2.vi.1971 (NSW); *N.T. Burbidge 5488*, 14km north of Cunnamulla, 6.ix.1956 (BRI, CANB); *5511*, 19km north of Emmet on Isisford road, 8.ix.1956 (BRI, CANB); *5565*, Baffle Creek, 13.ix.1956 (CANB); *I.J. Dale 163*, 125km N.W. of Clermont, 29.vii.1977(BRI); *S.L. Everist 3081*, between Bendena and Theodore Tank, 14.vii.1947 (BRI); *3516*, 61km west of Condamine, 12.x.1948 (CANB); *3672*, Cashel Vale Station, 28.iv.1949 (BRI); *6115*, 19km north of St George, 12.ix.1959 (BRI); *L. Pedley 764*, Hannaford, 25.iii.1961 (CANB); *R.W. Purdie 103*, 62km S.E. of Charleville on Boatman road, 23.iii.1976 (BRI); *I. Romano s.n.*, Three Moon Creek, near Monto, Nov. 1974 (BRI 182272); *C.T. White 12228*, Bybera Station, 28.ix.1935 (BRI).

NEW SOUTH WALES: *P.M. Blundell s.n.*, Bingarra, May 1911 (NSW 48739); *E.F. Constable s.n.*, Mount Harris Station, 30.iv.1952 (NSW 20593); *D.F. Thompson 1709*, Tipperary Station, Lightning Ridge, 19.v.1976 (NSW); *J. Thompson 1118*, 14km from Brewarrina on Tarcoon road, 30.viii.1971 (NSW).

Subsp. **sessilifolia** P. Horton, subsp. nov.

Type: *P.K. Latz 2503*, Marshall River, Northern Territory, 19.v.1972 (NT, holo.; ADW; BRI; CANB; NSW).

Folia basi petiolata, caulina pandurata ad sessilia super; basis laminae obtusa vel cuneata, supra auriculata et amplexicaula. Testa seminis favosa (interdum irregulariter).

Fig. 10. (a) *Nicotiana megalosiphon* subsp. *sessilifolia*, voucher *P.K. Latz 2503* (CANB); (b) *N. megalosiphon* subsp. *megalosiphon*, voucher *N.T. Burbidge 5512* (CANB); (c) *N. simulans*, voucher *R.H. Kuchel 607* (AD).

Basal *leaves* petiolate, the cauline ones soon becoming pandurate to sessile above; lamina base obtuse or cuneate, becoming auriculate and stem-clasping above. *Seed testa* honeycombed (occasionally irregularly so). (Figs. 4b, 10a).

Chromosome number: not known.

Distribution and habitat

N. megalosiphon subsp. *sessilifolia* occurs across central to southern Northern Territory roughly north of Alice Springs, across to western Queensland (Fig. 17). It grows in sandy, loam or clay soils along creeklines or near water, occasionally in soil traps on rocky hillsides.

Notes

Robust specimens of this subspecies may occasionally be confused with *N. gossei*, but can be distinguished by the reticulate seed ornamentation, non-woolly vestiture, shorter calyx and a number of other characteristics.

Selected specimens (total seen about 123)

NORTHERN TERRITORY: *G. Chippendale s.n.*, Long Hole, 48km N.W. of Willowra Homestead, 30.vii.1958 (AD 96145139), BRI 32503, MEL, NSW 60701, NT 4754); *J.B. Cleland s.n.*, Mt Palmer, 26.viii.1956 (AD 95929143); *P.K. Latz 643*, old Huckitta Homestead, 20.vii.1970 (NT); *785*, Palm Valley, 28.ix.1970 (AD, CANB, MEL, NT); *1032*, Serpentine Gorge, 28.xii.1970 (AD, NT); *1059*, Elkera No.2 Bore, 5.i.1971 (AD, MEL, NT); *1695*, Georgina Downs Homestead, 28.vii.1971 (ADW); *2154*, Mount Wedge Station, 20.i.1972 (CANB, NT); *2271*, Amburla Station, 5.iv.1972 (AD, CANB, NT); *2500*, 5km S.S.E. of Eastern Chief Bore, 18.v.1972 (AD, ADW, NT); *2549*, Toko Hills, Tobermorey Station, 22.v.1972 (ADW, NT); *2571*, Field River, 23.v.1972 (ADW, BRI, NSW, NT); *4302*, Old Station Well, Mount Riddock Station, 12.ix.1973 (ADW); *4431*, Mt Alooarjara, 3.x.1973 (NT); *6971*, Davenport Range, 5.v.1977 (ADW, BRI, NT); *H.S. McKee 8570*, Napperby Creek, 22.ii.1961 (NSW); *R. Swinbourne 355*, 6km north of Alice Springs, 30.vii.1962 (CANB, NSW, NT); *384*, ca 24km N.W. of Aileron Homestead, 2.viii.1962 (CANB, NSW, NT).

QUEENSLAND: *S.L. Everist 3229*, Hyperion block near Quita Creek, Kallala Station, 22.xi.1947 (BRI, CANB); *S. Jacobs 1303*, Leichhardt Falls, 27.iv.1974 (NSW).

10. **N. simulans** N.T. Burbidge, Aust. J. Bot. 8:365, fig. 10, pl. 16 fig. 1 (1960).

Type: *N.T. Burbidge 4625*, ca 40 miles (64km) from Mount Willoughby towards Mabel Creek, S. Aust., 10.x.1955 (CANB, holo.).

Herb to 0.7(-1.2)m high, with 1-5 or occasionally more stems. *Indumentum* on all parts a dense to moderately sparse pubescence of glandular trichomes. *Leaves* both radical and cauline or mostly radical, petiolate near base of plant, becoming sessile above; *lamina* (1-)2-10(-23)cm long x (0.2-)0.5-5(-12)cm wide, elliptic or occasionally spatulate (rarely broadly so), becoming narrow-ovate or -elliptic above, to lanceolate (rarely linear) at base of inflorescence; apex acute, or occasionally obtuse on basal leaves, to acuminate above; base obtuse to attenuate, often slightly stem-clasping if leaves sessile; margin entire or occasionally sinuate; *petiole* to 5(-9)cm long, narrowly to moderately broadly winged, insertion on stem occasionally simple, usually slightly stem-clasping. *Inflorescence* an elongate, few-branched panicle, occupying up to $^1/_2$ or occasionally more (sometimes almost all) the length of stems; *bracts* 3-25(-47)mm long, linear-lanceolate to lanceolate, occasionally leafy at base of inflorescence; *pedicels* to 22(-42)mm in fruit. *Calyx* (5-)8-15(-17)mm long; sepals linear to lanceolate, subequal, fused for $^1/_2$-$^2/_3$ their length (rarely more); intersepalar membranes long, often conspicuous. *Corolla tube* 22-38(-42)mm long, (1-)1.5-2.5(-3.5)mm wide at top of calyx; tube proper not distinct from throat cylinder; throat cup not very distinct, slightly or strongly asymmetrical; *corolla limb* (6-)10-20(-24)mm diameter, closing in sunlight, lobes emarginate (or very shallowly so to almost obtuse), fused for $^1/_4$-$^4/_5$ their length. Upper 4 *stamens* almost level or usually subdidynamous, in throat cup or the longer pair slightly exserted, fifth stamen between the two of the shorter pair; *filaments* of upper 4 stamens 1-5 mm long, of fifth 2-8 mm long

and inserted onto corolla in distal $^1/_2$ of tube, or half way down. *Capsule* (5-)8-11(-13) mm long, usually shorter than calyx, occasionally equalling or longer than calyx, ovoid to ellipsoid (length:breadth 2:1). *Seeds* (0.5-)0.7-0.9(-1.1) mm long, reniform or acutely angled; testa honeycombed or irregularly so. (Fig. 10c).

Chromosome number: n = 20 (Burbidge, 1960:367).

Distribution and habitat

N. simulans has a widespread distribution extending from near the coast in central Western Australia across through southern Northern Territory (roughly south of Alice Springs) and northern regions of South Australia, to north-western and central New South Wales (with one collection from southern Queensland) (Fig. 17). It grows in sandy or rocky areas, often in the shelter of boulders or trees.

Notes

N. simulans may occasionally be confused with depauperate specimens of *N. megalosiphon* with unusually short flowers, but it can be distinguished from the latter by its subdidynamy of stamens. Cleistogamous flowers are occasionally formed.

Selected specimens (total seen about 304)

WESTERN AUSTRALIA: *T.E.H. Aplin B2*, Boolathana Station, 5.xi.1963 (AD, PERTH); *A.C. Beauglehole 11428*, Weeli Wolli Creek, 13.viii.1965 (Beauglehole Herbarium); *N.T. Burbidge 6031*, 66 km south of Roy Hill towards Mundiwindi, 8.v.1958 (AD, CANB); *A.S. George 3837b*, Mt Eveline 22.viii.1962 (PERTH); *D.E. Symon 9914*, 10 km north of Broad Arrow, 11.v.1975 (ADW, PERTH).

NORTHERN TERRITORY: *G. Chippendale s.n.*, Kalamurta Dam, 7.vii.1955 (NSW 48697, NT 1364); *P.K. Latz 5081*, Mulga Park Station, 29.iv.1974 (ADW, MEL, NT); *6803*, Andado Station, 15.iv.1977 (AD, ADW, NSW, NT).

QUEENSLAND: *L. Pedley 2441*, near Paroo River ca 32 km N.N.E. of Eulo, 8.ix.1967 (BRI).

NEW SOUTH WALES: *G.M. Cunningham 847*, 13 km west of Nyngan on Cobar road, 24.v.1969 (NSW); *C.W.E. Moore 4832*, Tundulya Station, 18.iv.1967 (CANB); *L.R. Richley 107*, Fowlers Gap, 20.ix.1973 (AD); *1385*, St Helena Paddock, Purnanga Station, 17.ii.1974 (NSW).

SOUTH AUSTRALIA: *A.C. Beauglehole 25632*, Everard Ranges, Mt Illbillee area, 27.vi.1968 (Beauglehole Herbarium); *P. Horton 199*, The Margaret River, ca 14 km S.E. of Coward Springs Siding, 6.x.1978 (ADW); *B. Lay 252*, Leaks Bore, Bon Bon Station, 5.v.1971 (AD); *T.R.N. Lothian 812*, Ant Bore, De Rose Hill Station, July 1954 (AD); *R.D. Pearce 135*, 6 km from Paralana Hot Springs on Arkaroola road, 2.x.1978 (ADW); *D.E. Symon 11468*, Arckaringa Hills, 21.x.1978 (ADW).

11. **N. rosulata** (S. Moore) Domin, Biblioth. Bot. 89:1146, pl.36 fig.11 (1929).

Type: *S. Moore s.n.*, West Australian Goldfields, bank of creek near Wilsons Pool, Western Aust., April 1895 (BM-photo. in ADW, lecto., here proposed; K-photo. in ADW).

N. suaveolens var. *rosulata* S. Moore, J. Linn. Soc. 34:206 (1898), basionym.

N. stenocarpa Wheeler, Univ. Calif. Publ. Bot. 18:61 (1935).

Type: *J.H. Maiden s.n.*, Laverton, Western Aust., Sept. 1909 (NSW, holo.).

Herb to 0.8(-1) m high, with one or a few leafless or sparsely-leaved stems, occasionally somewhat woody at the base. *Indumentum* on bracts, pedicels and calyx a sparse to fairly dense covering of glandular trichomes. *Leaves* petiolate or if cauline leaves present then occasionally the distal-most sub-sessile; *lamina* (1-)3-15(-21) cm long x (0.1-)1-7(-11.5) cm wide, elliptic or occasionally ovate or spatulate, or narrowly so, becoming narrower to lanceolate or linear above; apex obtuse to acute, acuminate on distal leaves; base attenuate; margin entire or slightly sinuate; *petiole* (0-)1-5(-8) cm long, narrowly winged, insertion onto stem simple. *Inflorescence* an elongate, few-branched panicle, occupying distal $^1/_2$ ($^3/_5$, rarely more) the length of stems; *bracts* 2-11(-30) mm long, linear to lanceolate; *pedicels* to 20(-36) mm long in fruit. *Sepals* linear to linear-lanceolate (rarely lanceolate), equal to unequal, fused for $^1/_2$-$^2/_3$($^3/_4$) their length; intersepalar membranes

long but fairly inconspicuous. *Corolla tube* 1-2 mm wide at top of calyx; tube proper not distinct from throat cylinder; throat cup not very distinct or indistinct, almost symmetrical to distinctly asymmetrical; *corolla limb* 7-25 mm diameter, closing in sunlight, lobes emarginate, fused for $^2/_3$-$^4/_5$ their length. *Filaments* of upper 4 stamens 1-3.5 mm long, of fifth 4.5-18 mm long, inserted onto corolla in distal $^1/_2$ of tube. *Capsule* (6-)7-16 mm long, ellipsoid or narrowly so (length: breadth 2:1 to 3:1 [-7:2]). *Seeds* 0.7-1.1 mm long; testa with irregular honeycombs to short round-edged wrinkles.

Notes

Moore (1898) did not specify a particular specimen as the holotype of *N. suaveolens* var. *rosulata* (nor did Domin (1929) for *N. rosulata*) and since the type collection has been split a lectotype should be chosen. The BM specimen (which Burbidge (1960) quoted as the holotype) is here nominated as the lectotype.

Cleistogamous flowers are occasionally formed in this species. In addition, the corolla tube of *N. rosulata* subsp. *rosulata* exhibits considerable variation in length, similar to that found in *N. occidentalis* subsp. *obliqua*, and is usually either short (less than 22 mm) or long (more than 25 mm) with occasional specimens intermediate in length. As with *N. occidentalis* subsp. *obliqua* there appears to be no correlation between tube length and habitat (as indicated on herbarium labels) or physical state of the plant, but in general the short-flowered specimens occur in the more south-western part and the long-flowered in the more north-eastern part of the range of *N. rosulata* subsp. *rosulata*. Thus a cline of corolla tube length occurs over the range of *N. rosulata*, the tube being very long in the north-east (subsp. *ingulba*) and becoming progressively shorter to the south-west (subsp. *rosulata*).

Subsp. **rosulata**

Leaves and proximal parts of stems pubescent or sparsely so with elongate eglandular trichomes; stems soon becoming glabrous more distally. *Leaves* all or mostly radical. *Calyx* (6-)8-15 mm long. *Corolla tube* (15-)17-37(-45) mm long. Upper 4 *stamens* almost level to subdidynamous, if subdidynamous then the fifth between the two of the shorter pair. *Capsule* equalling calyx or slightly shorter or longer. *Seeds* reniform or acutely angled, angle occasionally less than 45°. (Fig. 11a).

Chromosome number: n = 20 (Burbidge, 1960:348).

Distribution and habitat

N. rosulata subsp. *rosulata* occurs across central Western Australia and extends into western South Australia (Fig. 18); it grows mostly in sandy soils, occasionally stony, often along creeklines under trees.

Selected specimens (total seen about 100)

WESTERN AUSTRALIA: *T.E.H. Aplin 2364*, 5 km north of Agnew, 18.viii.1963 (MEL, PERTH); *A.M. Ashby 3566b*, Canning Stock Route between Weld Spring and Pierre Spring, Aug. 1970 (AD); *J.S. Beard 2642*, 8 km north of Paynes Find, 10.viii.1963 (PERTH); *A.C. Beauglehole 60123*, 171 km S.W. of Warburton Mission on Laverton road, 18.ix.1978 (Beauglehole Herbarium); *N.T. Burbidge 1225*, Pardoo, 24.vii.1941 (PERTH); *C.A. Gardner 2319*, Meekatharra, 16.vii.1931 (PERTH); *A.S. George 811*, ca 19 km west of Mount Magnet, 17.iv.1960 (PERTH); *3730*, 6 miles east of Leonora, 18.viii.1962 (PERTH); *L. Haegi 1105*, ca 5 km N.N.E. of Wongan Hills on Dalwallinu road, 23.ix.1976 (AD); *R.D. Royce 1977*, 32 km south of Jiggalong, 8.vi.1947 (PERTH): *T.L. Setter 363*, Gascoyne River 3 km south of Mt Deverell, 17.ix.1973 (ADW); *D.E. Symon 2472*, Glen Cumming, near Giles, Rawlinson Range, 2.viii.1962 (AD, ADW).

SOUTH AUSTRALIA: *R.B. Major 50*, ca 80 km S.W. of Mt Sir Thomas, 1966 (AD); *D.E. Symon s.n.*, cultivated, 16.xi.1965, from seed collected at Mt Christie (ADW); *D.J.E. Whibley 1117*, Wild Cat Bore, ca 25 km S.W. of Everard Park Homestead, 13.ix.1963 (AD, MEL).

Fig. 11. (a) *Nicotiana rosulata* subsp. *rosulata*, voucher *A.S. George 4471* (PERTH); (b) *N. rosulata* subsp. *ingulba*, voucher *M. Lazarides 8352* (NT); (c) *N. goodspeedii*, voucher *H. Turner s.n.* (AD 96221272).

Subsp. **ingulba** (J.M. Black) P. Horton, comb. nov.

Type: *E. Kramer s.n.*, Harpers Springs, Northern Territory, *s.dat.* (AD, holo.).

N. ingulba J.M. Black, Trans. R. Soc. S. Aust. 57:156, pl.9 fig.1 (1933), basionym.

Leaves and stems glabrous, or occasionally sparse, elongate, eglandular trichomes present at base of plant. *Leaves* mostly radical with a few cauline; cauline leaves rarely absent, occasionally numerous. *Calyx* (8-)10-17(-22)mm long. *Corolla tube* (19-)30-56 (-64)mm long. Upper 4 *stamens* subdidynamous, the fifth between the two of the shorter pair. *Capsule* usually shorter than calyx, rarely equalling or longer than calyx. *Seeds* reniform or acutely angled, angle often less than 45°. (Fig. 11b).

Chromosome number: n = 20 (Burbidge, 1960:348).

Distribution and habitat

This subspecies occurs in southern Northern Territory and in western Western Australia near the Northern Territory-South Australia border, where it overlaps the range of subsp. *rosulata*. In addition, a few collections of subsp. *ingulba* have been made from south-eastern Western Australia, somewhat removed from the major part of its range (Fig. 18). It grows in sand, usually in the shelter of trees.

Notes

There are no features which consistently distinguish between the two subspecies of *N. rosulata*. The combined characteristics of corolla tube length and presence or absence of pubescence near the base of the plant are generally satisfactory for their separation. However, one or both characters may often be intermediate between the two usual states (particularly in the range of overlap of the two subspecies), and when both are intermediate it is not possible to determine the specimen with confidence as one subspecies or the other. For these reasons *N. ingulba* was reduced to a subspecies of *N. rosulata*, the latter being the earlier published name.

N. rosulata subsp. *ingulba* was one of the native tobaccos often used by aborigines as a chewing tobacco (Latz, 1974).

Selected specimens (total seen about 145)

WESTERN AUSTRALIA: *W.H. Butler s.n.*, Lake Nyanga, Jan. 1962 (PERTH); *A.S. George 6016*, 3km west of Zanthus, 11.xi.1963 (PERTH); *8773*, 53km S.E. of Giles Meteorological Station, 19.vii.1967 (MEL, NT, PERTH).

NORTHERN TERRITORY: *N.T. Burbidge 4373*, ca 35km south of Alice Springs on railway line road, 29.ix.1955 (AD, CANB); *R.C. Carolin 5253*, ca 24km S.W. of Mt Currie, 18.viii.1966 (NSW, SYD); *G. Chippendale s.n.*, 11km S.E. of Maryvale Homestead, 3.ix.1956 (AD 96145138, CANB 98166, MEL *s.n.*, NSW 60704, NT 2767); *s.n.*, 19km N.W. of Harper Springs Homestead, 12.viii.1959 (AD 95952128, BRI 22389, NSW *s.n.*, NT 6462); *P.K. Latz 1699*, Arganara Creek, 28.vii.1971 (BRI, CANB, NT); *M. Lazarides 6060*, 27km south of Mount Wedge Station, 19.ix.1956 (AD, BRI, CANB, NSW, NT); *8352*, ca 111km S.E. of Docker River Mission on Ayers Rock road, 11.v.1977 (CANB, NT); *D.J. Nelson 415*, 17km north of Aileron, 2.viii.1962 (AD, CANB, NT); *R.A. Perry 3417*, 19km N.N.E. of MacDonald Downs Station, 12.iii.1953 (BRI, CANB, NT); *5338*, 42km north of Barrow Creek, 2.ix.1955 (AD, CANB, MEL, NSW, NT); *D.E. Symon 10385*, 13km north of Hugh River crossing on Erldunda road, 11.vi.1975 (ADW, NT).

12. **N. goodspeedii** Wheeler, Univ. Calif. Publ. Bot. 18:63 (1935).

Type: *Mrs Richards s.n.*, Fowlers Bay, S. Aust., 1879 (MEL *s.n.*, holo.).

Herb to 0.7(-1.0)m high, with several (up to 10 or occasionally more) leafless or sparsely-leaved stems. *Indumentum* on bracts, pedicels and calyx a fairly dense covering of glandular trichomes; leaves and stems glabrous, or occasionally sparsely-scattered eglandular trichomes present on young growth. *Leaves* mostly radical, petiolate or the uppermost cauline leaves subsessile to sessile; *lamina* (0.5-)1-11(-19)cm long x (0.1-) 0.5-3.5(-5.5)cm wide, elliptic to spatulate or narrowly so, to narrow elliptic above; apex

obtuse, acute or acuminate (narrower in cauline than in radical leaves); base attenuate; margin entire or slightly sinuate; *petiole* to 5(-8) cm long, narrowly winged, insertion onto stem simple. *Inflorescence* an elongate, few-branched panicle, occupying up to distal $^1/_2$ to $^2/_3$ (rarely more) the length of stems; *bracts* 1-5(-10) mm long, linear to lanceolate or narrow-elliptic; *pedicels* to 20(-29) mm long in fruit. *Calyx* 4-10(-12) mm long; sepals lanceolate to linear-lanceolate, equal to unequal, fused for $^1/_2$ to $^3/_4$ ($^4/_5$) their length; intersepalar membranes long but fairly inconspicuous. *Corolla tube* (8-) 10-19 mm long, 1-3(-3.5) mm wide at top of calyx; tube proper slightly narrower than throat cylinder; throat cup not very distinct, symmetrical; *corolla limb* (5-)6-12 mm diameter, closing in sunlight, lobes obtuse to emarginate, fused for $^1/_2$-$^2/_3$ their length. Upper 4 *stamens* level or almost so, in throat cup; *filaments* of upper 4 stamens 0.5-4.5 mm long, of fifth (4-) 5-9.5 mm long and inserted onto corolla in proximal $^1/_2$ of tube. *Capsule* 5-10 mm long, equalling calyx or occasionally slightly shorter or longer, ellipsoid or ovoid-ellipsoid (length:breadth 2:1 or occasionally 5:2 or 3:2). *Seeds* 0.5-1.0 mm long, C-shaped; testa with short, round-edged wrinkles. (Fig. 11c).

Chromosome number: n = 20 (Wheeler, 1935:63).

Distribution and habitat

N. goodspeedii extends from south-eastern Western Australia across the Nullarbor Plain, around the head of Spencers and St Vincents Gulfs and along the Murray River and the plains to its north, into south-western New South Wales (Fig. 18). It grows mostly in open areas, often disturbed, such as caves, dams, water courses, cliffs, sand-dunes and roadsides, and usually in alkaline soils, often sand over limestone.

Selected specimens (total seen about 227)

WESTERN AUSTRALIA: *T.E.H. Aplin 1715*, Mundrabilla Station, 4.ix.1962 (PERTH); *D.W. Goodall 2460*, 5 km east of Breakaway Dam, Koonjarra, 1.xii.1965 (PERTH); *R.S. Vickery s.n.*, Neebubbie Cave, ca 24 km W.N.W. of Eucla, 5.i.1957 (AD 96413011); *P.G. Wilson 7650*, Kanandah Station, 3.ix.1968 (PERTH).

NEW SOUTH WALES: *G.M. Cunningham & P.L. Milthorpe 4316*, Booberoi Regeneration Area, Booberoi Railway Siding, 17.iii.1976 (NSW).

VICTORIA: *A.H. Corrick 8*, Middle Marsh, ca 24 km west of Kerong, 17.ii.1974 (MEL).

SOUTH AUSTRALIA: *B.J. Blaylock 2077*, ca 7 km S.S.W. of Scrubby Peak, 8.ix.1972 (AD); *R.J. Chinnock 1184*, 15 km east of Koonalda Homestead, 20.ix.1973 (AD); *P.J. Cole 11*, near Saltia, Pichi Richi Pass, 18.v.1967 (AD); *L. Haegi 621*, ca 6 km S.S.W. of Koonamore Homestead, 30.iii.1975 (ADW); *P. Horton 202*, dam, ca 8.5 km S.E. of Ketchowla Homestead, 17.vi.1979 (ADW); *A.E. Orchard 3193*, ca 5 km N.E. of Yalata Swamp Well, 6.i.1971 (AD); *R.D. Pearce 123*, 6.4 km from Tickera on road to Wallaroo, 21.v.1978 (ADW); *R.A. Perry 5567*, 24 km north of Maralinga, 26.i.1956 (CANB); *M.E. Phillips s.n.*, 58 km from Iron Knob, towards Port Augusta, 3.ix.1962 (AD 96830139); *D.E. Symon s.n.*, near Inila Rock, 30.ix.1959 (ADW 21254); *3870*, Murray River front at Overland Corner, 12.x.1965 (ADW, CANB); *8815*, 17.7 km north of Two Wells, 17.v.1974 (ADW).

13. **N. suaveolens** Lehm., Gen. Nicot. 43 (1818) (n.v.).

Type: "*N. undulata* ex Hortus Malmaison, Herbier de Ventenat", cultivated from seeds sent from England by M. le Chevalier Banks, originally from Port Jackson, New South Wales, *s.dat.* (G-photo. in ADW, holo.).

N. undulata Vent., Jard. Malm. 1, tab. 10 (1804), nom. illeg., non R.&P.

N. suaveolens var. *undulata* (Vent.) Comes, Monogr. Nicot.: 40 (1899).

N. exigua Wheeler, Univ. Calif. Publ. Bot. 18: 64 (1935) (see Notes).

Type: cultivated plant, 31424 P6, grown at University of California Botanic Gardens 1932 from seed accession 1931-59 collected *J.H. McCarthy s.n.*, Dalby, Qld, *s.dat.* (UC, holo., n.v.; AD).

Herb to 0.8(-1.5) m high, with one or a few stems, occasionally woody at the base. *Indumentum* of bracts, pedicels and calyx a fairly sparse to dense covering of glandular trichomes; stems and leaves glabrous, or basal leaves, stem bases and young growth sparsely to fairly densely covered with eglandular trichomes, often elongate and occasionally white-woolly. *Leaves* both radical and cauline, rarely mostly or all radical,

petiolate; *lamina* (2-)4-16(-31)cm long x (0.3-)1-8(-19.5)cm wide, ovate or elliptic or narrowly so, becoming narrower above to lanceolate to linear; apex obtuse or acute, becoming narrower above to acute to acuminate; base cuneate or attenuate, occasionally obtuse, to attenuate above; margin entire to sinuate or occasionally undulate; *petiole* to 7 (-16)cm long, narrowly or occasionally moderately broadly winged, insertion onto stem simple or slightly stem-clasping. *Inflorescence* an elongate, few-branched panicle, or occasionally several-branched, occupying up to $^2/_5(-^1/_2)$ the length of stems; *bracts* 1-13mm long, linear to lanceolate; *pedicels* to 20(-25)mm long in fruit. *Calyx* (6-)8-13 (-26)mm long; sepals linear to lanceolate, equal or subequal, fused for $^1/_2$-$^3/_5(-^2/_3)$ their length; intersepalar membranes long and usually fairly conspicuous. *Corolla tube* (17-) 22-40(-55)mm long, (1.5-)2-4(-6)mm wide at top of calyx; tube proper distinctly narrower than throat cylinder; throat cup indistinct, symmetrical; *corolla limb* 14-25 (-37)mm diameter, closing in sunlight, lobes emarginate or obtuse, fused for $^1/_3$-$^1/_2$ their length. Upper 4 *stamens* level or almost so, in throat cup or slightly exserted; *filaments* of upper 4 stamens 1-3mm long, of fifth 11-16mm long and inserted onto corolla in proximal $^1/_2$ of tube. *Capsule* 7-12mm long, shorter than or equalling calyx (rarely longer than calyx), ovoid or ovoid-ellipsoid (length:breadth 2:1 to 3:2). *Seeds* 0.7-1.0(-1.2)mm long, reniform or acutely angled, angle occasionally $<45°$, testa irregularly honeycombed to wrinkled (Fig. 12a).

Chromosome number: n = 16 (Wheeler, 1935:58). Wheeler also described two tetraploid strains (n=32) grown at the University of California Botanic Gardens.

Distribution and habitat

N. suaveolens is distributed through eastern and southern New South Wales, and in scattered areas of Victoria (Fig. 19). It grows in sandy to stony soils on creek banks or rocky slopes or in the understorey of woodland or scrub.

Notes

The type specimens of *N. exigua* have the appearance of small-flowered *N. suaveolens*, with which they share the same chromosome number (n=16, Wheeler, 1935), but the type locality is considerably further north than the northernmost part of the range of *N. suaveolens*. *N. exigua* is therefore tentatively placed in synonymy under *N. suaveolens*. Wheeler (1935) assigned no specimens to *N. exigua* other than the type specimens. Of the specimens which Burbidge (1960) identified as *N. exigua*, most have C-shaped seeds (unlike the type specimens which have seeds resembling those of *N. suaveolens*) and are almost certainly *N. velutina* (to which I have referred them) although with unusually glabrescent stems. The remainder appear to be *N. suaveolens*. Burbidge (1960) believed *N. exigua* to be closely related to and possibly conspecific with *N. goodspeedii*. This is almost certainly a result of her identification of specimens with C-shaped seeds (a character shared by *N. velutina* and *N. goodspeedii* but not by *N. exigua*) as *N. exigua*. With their C-shaped seeds and often glabrescent stems, they superficially resemble *N. goodspeedii*, which in contrast has glabrous stems.

Selected specimens (total seen about 188)

NEW SOUTH WALES: *N.T. Burbidge 6421*, Yenda to Rankins Springs Stock Route, N.W. of Yenda, 30.vii.1959 (AD, BRI, CANB, MEL, NSW); *E.F. Constable s.n.*, Abercrombie Caves, 22.iii.1955 (NSW 31207); *J. Corbin s.n.*, 24km north of Griffith, 24.x.1962 (CANB 118021, NSW 141413); *A.B. Costin s.n.*, Tin Hut, near Jacobs River, 6.xi.1948 (NSW 48764); *S.L. Everist S23*, 30.5km S.S.E. of Coonamble on Gilgandra Road, 7.xii.1969 (BRI); *L. Haegi 1355*, 2km south of Coopers Bridge over Lachlan River on Hillston Road, 7.ix.1977 (AD); *S. Jacobs 2353*, Bar Island, Hawkesbury River, 22.vi.1975 (NSW); *L.A.S. Johnson s.n.*, ca 16km north of Tooraweenah on Coonamble road, 16.iv.1952 (NSW 20568); *P. Martensz 173*, Bundure Station, 23.v.1969 (CANB, NSW); *R. Pullen 4173A*, Bungonia Gorge, 10.xi.1966 (CANB); *A. Rodd 412*, Culoul Range, 5.ii.1967 (NSW).

VICTORIA: *A.C. Beauglehole 40432*, Timberoo Forest Reserve, 21.ix.1972 (MEL); *T. Henshall s.n.*, Dargo High Plains, Jan. 1966 (NT 46052); *R. Melville 3150*, Cape Schanck, Mornington Peninsula, 8.ii.1953 (AD, BRI, MEL, NSW); *T.B. Muir 2845*, Maribyrnong River at Bulla, 18.v.1963 (MEL); *K.C. Rogers s.n.*, The

Fig. 12. (a) *Nicotiana suaveolens*, voucher *A.V. Hill & C.J. Shepherd s.n.* (CANB 125987); (b) *N. maritima*, voucher *J.Z. Weber 3908* (AD); (c) *N. velutina*, voucher *P. Horton 191* (ADW).

Pyramids, Murrindal River, ca 16 km north of Buchan, 10.i.1962 (MEL); *C.J. Shepherd & M. Gray 5632*, Running Creek, Deddick to Tubbut Road, 30.x.1964 (BRI, MEL, NSW); *J.H. Willis s.n.*, Rileys Creek gorge, ca 2 km upstream from road crossing at Staughton Vale, 20.x.1955 (MEL); *s.n.*, at Snowy River crossing of Vic.-N.S.W. border, 22.ii.1962 (CANB 242565, MEL).

14. **N. maritima** Wheeler, Univ. Calif. Publ. Bot. 18:56 (1935).

Type: *J.B. Cleland s.n.*, Hallett's Cove, Sth Aust., Sept. 1932 (UC, n.v., holo.; AD 97615147).

Herb to 0.7(-1) m high, with 1 or a few (up to 4 or 5) stems occasionally tinged bluish, often woody at the base in older plants. *Indumentum* of leaves and stems a sparse to dense pubescence of eglandular trichomes, usually conspicuously white- or grey-woolly at base of stems; stems usually glabrescent; bracts, pedicels and calyx with moderately sparse to dense glandular trichomes. *Leaves* mostly radical, petiolate or the distal-most subsessile to sessile; *lamina* (1-)2-13(-22) cm long x (0.1-) 0.5-7(-14) cm wide, ovate or elliptic, occasionally widely so or spatulate, narrower above to narrow elliptic or lanceolate, occasionally linear, at base of inflorescence; apex obtuse or acute, to acuminate on distal leaves; base narrow cuneate or attenuate; margin sinuate or occasionally undulate, rarely entire; *petiole* to 6.5(-9) cm long, broadly (occasionally fairly narrowly), winged, insertion onto stem simple or slightly stem-clasping. *Inflorescence* an elongate, few-branched panicle or occasionally several-branched, occupying up to $^1/_2(-^2/_3)$ the length of stems; *bracts* 2-12 (-25) mm long, linear to lanceolate; *pedicels* to 21 (-30) mm long in fruit. *Calyx* 6-12 (-16) mm long; sepals linear-lanceolate to lanceolate, subequal, fused for $^1/_3$-$^2/_3$ their length (rarely more); intersepalar membranes long, often fairly conspicuous. *Corolla tube* 13-25(-30) mm long, (1.5-)2-5 mm wide at top of calyx; tube proper distinctly narrower than throat cylinder, throat cup indistinct, symmetrical or almost so; *corolla limb* 7.5-20 (-24) mm diameter, closing in sunlight, lobes obtuse or usually emarginate, fused for $(^1/_4-)\,^1/_3$-$^1/_2(-^2/_3)$ their length. Upper 4 *stamens* level or almost so, in throat cup; *filaments* of upper 4 stamens 0.5-4 mm long, of fifth 6-11.5 mm long and inserted onto corolla in proximal $^1/_2$ of tube. *Capsule* (4.5-)6-11(-12) mm long, equalling or slightly shorter than calyx, occasionally slightly longer, ellipsoid to ovoid-ellipsoid or widely so (length: breadth 2:1 to 3:2, rarely 1:1). *Seeds* 0.6-1.1 mm long, reniform or acutely angled, occasionally oblong or L-shaped; testa irregularly honeycombed to wrinkled (Figs. 4f, 12b).

Chromosome number: n = 16 (Wheeler, 1935:57).

Distribution and habitat

N. maritima occurs principally in coastal regions of South Australia, on Eyre, York and Fleurieu Peninsulas, and also on offshore islands including Kangaroo Island (Fig. 19). A few old collections indicate that its range extends, or at least once extended, into Victoria: *J.P. Eckert s.n.*, Wimmera, 1891 (MEL 85766) and *Anonymous s.n.*, Grampians, *s.dat.* (MEL s.n.). This species usually grows in rocky areas in sand or gravelly soil or amongst rocks, often on the coastline or along creek-banks near the coast (but may also grow further inland).

Notes

N. maritima appears to be closely related morphologically to *N. suaveolens* and *N. velutina*, with which it shares the same chromosome number (n=16). In effect *N. maritima* replaces *N. suaveolens* at the western margin of the latter's range and continues the sweep of these two species across south-eastern Australia. It is, however, more closely associated with coastal regions than is *N. suaveolens*.

Selected specimens (total seen about 148)

SOUTH AUSTRALIA: *C.R. Alcock 2633*, Big Swamp, Flinders Highway, 4.ii.1969 (AD, ADW, CANB); *B.J. Blaylock 1240*, Peella Rock, 26.iv.1969 (AD); *B. Copley 1626*, Yararoo Station via Kulpara, 5.xi.1967

(AD); *Hj. Eichler 19452*, ca 11 km north of Elliston on Streaky Bay road, 12.x.1967 (AD); *P. Horton 203*, east side of Marble Range, west of Marble Range Homestead, 28.ix.1979 (ADW); *D.N. Kraehenbuehl 2672*, Sellicks Beach scrub, 3.xi.1968 (AD); *P.K. Latz 134*, Waterfall Gully, Adelaide, 24.ix.1967 (NT); *T.R.N. Lothian 1130*, Wool Bay, 7.x.1962 (AD); *R. Schodde 1051*, Strangway Waterfalls ca 15 km N.W. of Victor Harbor, 28.xii.1958 (AD, CANB); *T. Smith 452*, Whittons Bluff, Port Noarlunga, 27.ix.1967 (AD); *A.G. Spooner 3588*, Kinchina, 21.ix.1974 (AD); *D.E. Symon 6613*, Dorothea Island, Investigator Group, 10.i.1969 (AD, ADW, CANB); *8855*, just west of Walkers Flat, 7.ix.1974 (ADW); *8927*, west end of Carrappee Hill, 15.ix.1974 (ADW); *10563*, Second Valley, 28.i.1976 (ADW); *J.R. Wheeler 790*, western slopes of the Blue Range, Hincks National Park, 7.x.1968 (AD); *L.D. Williams 578*, Woods Well to Culburra Road, 6.xii.1959 (AD); *P.G. Wilson 480*, Minnipa Hill, 15.x.1958 (AD).

15. **N. velutina** Wheeler, Univ. Calif. Publ. Bot. 18:55 (1935).

Type: *A. Morris s.n.*, Broken Hill, N.S.W., 4.x.1920 (NSW, holo.).

N. suaveolens var. *debneyi* F.M. Bail., Queensl. Fl. 4:1096 (1901), *nom. nud.*, based on *G.L. Debney s.n.*, Monkira Station, Diamantina River, Qld, Aug. 1891 (BRI 14168).

Herb to 0.8(-1.5) m high, with a few (up to 6[-10]) stems. *Indumentum* on all parts a sparse to dense covering of eglandular and glandular trichomes; stems occasionally glabrescent. *Leaves* both radical and cauline or mostly radical, petiolate or the distalmost subsessile to sessile; *lamina* (1-)2-15(-28) cm long x (0.2-)0.5-7(-12) cm wide, elliptic (rarely spatulate) or narrowly so, becoming narrower to lanceolate or linear above; apex obtuse or acute, to acuminate on distal leaves; base attenuate or occasionally cuneate or narrowly so; margin entire to sinuate, rarely undulate; *petiole* to 9(-15) cm long, narrowly or occasionally moderately broadly winged, insertion onto stem simple or occasionally slightly stem-clasping. *Inflorescence* an elongate, few-branched panicle, or occasionally several-branched, occupying up to $^2/_3$ (rarely almost all) the length of stems; *bracts* 2-12(-15) mm long, lanceolate to linear-lanceolate; *pedicels* to 29(-35) mm long in fruit. *Calyx* (5-)7.5-13(-17) mm long; sepals lanceolate to linear-lanceolate, subequal (rarely unequal), fused for ($^2/_5$-)$^1/_2$-$^2/_3$(-$^3/_4$) their length; intersepalar membranes usually fairly indistinct, occasionally conspicuous. *Corolla tube* (11-)13-27(-35) mm long, (1-)1.5-3.5(-4.5) mm wide at top of calyx; tube proper distinctly narrower than throat cylinder; throat cup usually indistinct, symmetrical or almost so; *corolla limb* 7-24(-30) mm diameter, closing in sunlight, lobes obtuse to emarginate, fused for ($^1/_4$-)$^1/_3$-$^3/_4$ their length. Upper 4 *stamens* level or almost so, in throat cup; *filaments* of upper 4 stamens 0.3-3.5 mm long, of fifth 5-10 mm long and inserted onto corolla in proximal $^1/_2$ of tube. *Capsule* (5-)7-11 mm long, slightly shorter than or equalling calyx, occasionally slightly longer, ellipsoid to ovoid-ellipsoid (length:breadth 2:1, occasionally 5:2, rarely 3:2). *Seeds* 0.5-1.0 mm long, C-shaped or occasionally angled (<45°), or occasionally angled (>45°) or strongly reniform; testa with round-edged wrinkles or occasionally irregularly honeycombed. (Figs. 4e, 12c).

Chromosome number: n = 16 (Wheeler, 1935:56).

Distribution and habitat

N. velutina occurs across southern Northern Territory, most of South Australia, southern Queensland (except near the coast), central and western New South Wales, and in north-western Victoria (Fig. 19). This common species grows almost exclusively in sandy areas, often on the dunes surrounding salt lakes.

Notes

Despite the presence of apparently suitable habitat in eastern Western Australia, no convincing collections of *N. velutina* from this region were seen. Three Western Australian collections from near the Northern Territory-South Australia border (*D.E. Symon 2175*, *2339*, and *2445*) resemble *N. velutina*, but the seeds are mostly not C-shaped and are similar to those of *N. rotundifolia*. They are probably simply aberrant specimens of *N. velutina*.

N. velutina is typically fairly densely pubescent on all parts, but occasional specimens occur with glabrescent stems, particularly in the Murray River region of eastern South Australia and along the eastern margin of the species' range in Queensland. Many specimens from the latter area were referred to *N. exigua* by Burbidge (1960; see notes under *N. suaveolens*, in which I have included *N. exigua*), but they can be distinguished from *N. suaveolens* by their C-shaped seeds.

Two species morphologically closely related to *N. velutina* are *N. maritima* and *N. suaveolens*; a close relationship is further indicated by their chromosome numbers, all n = 16. *N. velutina* represents the most inland and arid-adapted species of the group, and occupies the sand sheets to the north and west of the ranges of *N. maritima* and *N. suaveolens*.

Selected specimens (total seen about 894)

NORTHERN TERRITORY: *G. Chippendale s.n.*, Temple Bar Creek, 17 km S.W. of Alice Springs, 27.ix.1958 (AD 96145156, BRI 32504, CANB 98164, MEL, NSW 60702, NT 4968); *P.K. Latz 689*, 43 km S.S.W. of The Granites, 30.vii.1970 (CANB, NT); *M. Lazarides 6087*, 48 km S.S.W. of Napperby Station, 28.ix.1956 (AD, CANB, MEL, NT); *D.J. Nelson 59*, Sandover River, 5 km north of Utopia homestead, 7.x.1961 (CANB, MEL, NSW, NT).

QUEENSLAND: *S.T. Blake 10647*, Noondoo, 2.iii.1936 (BRI); *11184*, Cunnamulla, 12.iv.1936 (BRI); *D.E. Boyland 276*, Poeppel Corner, 24.ix.1960 (BRI, CANB); *S.L. Everist 5603*, Belmont Station, 11.ix.1956 (BRI, CANB).

NEW SOUTH WALES: *N.T. Burbidge 6625*, Lake Tandou, 22.vii.1960 (CANB, NSW); *6643*, 77 km north of Wentworth, 23.vii.1960 (NSW, CANB); *J. Pickard 2357*, 6 km S.E. of Pincally Homestead, 23.vii.1973 (NSW); *3058*, 11 km S.W. of Moalie Park Homestead on road to Salisbury Downs Station, 29.x.1976 (NSW).

VICTORIA: *A.C. Beauglehole 56124*, Lake Powell, 3.v.1977 (MEL).

SOUTH AUSTRALIA: *N. Forde 510*, 15 km west of Emu, 8.ix.1956 (AD, CANB, MEL, NSW); *P. Horton 200*, Hamilton Hill, 6.x.1978 (ADW); *M. Lazarides 8388*, Strzelecki Track, 45 km north of Moomba Gas Field, 18.v.1977 (AD, CANB, NSW); *R.D. Pearce 138*, Nooldoonooldoona Waterhole, 3.x.1978 (ADW); *R. Schodde 473*, ca 4 km south of De Rose Hill Station, 4.ix.1957 (AD, CANB); *D.E. Symon 8027*, between Lake View Dam and shores of Lake Frome, 17.ix.1972 (ADW).

16. **N. rotundifolia** Lindley, Bot. Reg. 24: misc. 59 (1838).

Type: cultivated plants? from seeds received by R. Mangles from "the neighbourhood of Swan River", W. Aust., *s.dat.* (not located).

N. fastigiata Nees in Lehm., Pl. Preiss. 1:343 (1845).

Type: *Preiss 1911*, "in solo humoso ad caput fluvii Cygnorum", 14.i.1840 (LD, holo.? No duplicates held at HBG, L or S. A sheet held at MEL bears the number 1911 but no further collection details; it may be a Preiss collection. Burbidge (1960) quotes a duplicate of *Preiss 1911* as being held at MEL).

N. neesii Lehm. ex Nees in Lehm., Pl. Preiss. 1:344 (1845).

Type: *Preiss 1912*, "in rupestribus umbrosis ad latus occidentale montis Brown, York", 4.ix.1839 (LD, holo.? No duplicates held at HBG, L or S).

N. suaveolens var. *rotundifolia* (Lindley) Comes, Monogr. Nicot.: 42 (1899).

N. rotundifolia Lindley subsp. *aridicola* N.T. Burbidge, Aust. J. Bot. 8:370, pl. 5 fig. 2, pl. 6 fig. 2, pl. 17 fig. 2 (1960).

Type: *N.T. Burbidge 2668*, Pioneer Rock, north of Lake Cowan, W. Aust., 19.ix.1947 (CANB, holo.).

Herb to 0.6(-0.9)m high, with 1-3 or occasionally more stems. *Indumentum* on all parts a sparse to dense pubescence of eglandular and glandular trichomes, often elongate; stems occasionally glabrescent. *Leaves* mostly or all radical or occasionally cauline leaves numerous, petiolate or occasionally the distal-most subsessile (rarely sessile); *lamina* (0.7-)1.5-11.5(-25)cm long x (0.2-)0.7-6(-16)cm wide, elliptic or occasionally narrowly or broadly so, becoming narrow-elliptic (occasionally narrow-ovate) above, to lanceolate to linear at base of inflorescence; apex obtuse or acute, to acuminate on distal leaves; base cuneate or attenuate, occasionally obtuse; margin entire to sinuate; *petiole* to 7(-14)cm long, narrowly winged, insertion onto stem simple, rarely slightly stem-clasping. *Inflorescence* an elongate, few-branched panicle,

occupying up to $^1/_2$ the length of stems; *bracts* (1-)2-15(-20) mm long, linear to lanceolate; *pedicels* to 23(-46) mm long in fruit. *Calyx* (5-)6-9(-13) mm long; sepals linear-lanceolate (rarely lanceolate), equal or subequal, fused for ($^2/_5$-)$^1/_2$-$^3/_5$ their length; intersepalar membranes long and usually conspicuous. *Corolla tube* 13-18 mm long, 1-2.5(-3) mm wide at top of calyx; tube proper narrower than throat cylinder or occasionally almost the same width; throat cup moderately or not very distinct, symmetrical; *corolla limb* 5-10 (-16) mm diameter, closing in sunlight, lobes emarginate and often deeply so, fused for $^2/_5$-$^2/_3$ their length. Upper 4 *stamens* level or usually slightly subdidynamous, in throat cup, fifth between the two of the shorter pair; *filaments* of upper 4 stamens 0.5-1.3 mm long, of fifth 4.5-8 mm long and inserted onto corolla in proximal $^1/_2$ of tube. *Capsule* (4-)5-8 (-9) mm long, shorter than or occasionally equalling calyx, ovoid or ovoid-ellipsoid (length:breadth 2:1, occasionally 3:2). *Seeds* 0.6-0.9(-1.1) mm long, reniform or acutely angled; testa with irregular honeycombs to short round-edged wrinkles. (Fig. 13a).

Chromosome number: n = 22 (Burbidge, 1960:370).

Distribution and habitat

N. rotundifolia occurs in south-western Western Australia (Fig. 19), in diverse habitats from granite outcrops to sandy watercourses, generally in the shelter of boulders or trees.

Notes

In the more western regions of the range of *N. rotundifolia* there is a trend towards increased leafiness of stems and a more honeycombed seed ornamentation (rather than serpentine). Thus eastern specimens often correspond with Burbidge's *N. rotundifolia* supsp. *aridicola* in having mostly radical leaves and seeds with serpentine ornamentation, and western specimens often correspond with subsp. *rotundifolia* (sensu Burbidge, 1960), with stems leafy below the inflorescence and seed coats irregularly honeycombed. However, the pattern of variation of either character is not always consistent. Furthermore, numerous specimens occur in which one or both characters are intermediate between their states in these two subspecies, and others in which one character is in the state found in one subspecies and the other character in that of the other subspecies. Burbidge (1960) considered that the shape of the calyx lobes differs between these two subspecies (lanceolate-acuminate in subsp. *rotundifolia* and linear or linear-subulate in subsp. *aridicola*), but I could find no such difference. For these reasons, and because the proportion of radical and cauline leaves is somewhat variable in most other Australian *Nicotiana*, and a certain degree of variation often occurs in seed ornamentation in other species, no formal taxa are recognized in *N. rotundifolia*.

Selected specimens (total seen about 99)

WESTERN AUSTRALIA: *T.E.H. Aplin 1757*, 150 km east of Norseman, 5.ix.1962 (ADW, PERTH); *2577*, 18 km south of Nanambinia Station, 23.x.1963 (PERTH); *E.T. Bailey 406*, Muresk, Sept. 1945 (PERTH); *N.T. Burbidge s.n.*, Badjanning Hill, near Wagin, Dec. 1955 (CANB 188280, NSW 141417); *204*, near Trial Mill, Glenorn Station, 19.viii.1938 (PERTH); *4881*, 40 km south of Coolgardie on Norseman road, 17.xii.1955 (CANB); *Hj. Eichler 20174*, Lort River near crossing of the Esperance to Ravensthorpe road, 11.x.1968 (AD, PERTH); *C.A. Gardner s.n.*, Nalyaring Well, 2.viii.1939 (PERTH); *A.S. George s.n.*, Canning River between Maddington and Gosnells, 16.ii.1965 (PERTH); *7363*, Tuttanning Reserve, 17.xi.1965 (PERTH); *L. Haegi 1151*, ca 2 km east of Kalbarri on Binnu road, 26.ix.1976 (AD, BRI); *R. Melville 4225*, 34 km east of Pindar, 20.vii.1953 (AD, MEL, NSW, PERTH); *R.A. Rose 128*, Bromus, July 1963 (PERTH); *R.D. Royce 4425*, Comet Vale, 23.ix.1953 (PERTH); *9700*, Watheroo National Park, 7.x.1971 (PERTH).

17. **N. glauca** Graham, Bot. Mag. 55, tab. 2837 (1828); Edinb. New Phil. Jour. 5:175 (1828) (n.v.).

Type: cultivated 1828 at Royal Botanic Garden, Edinburgh, from seed "communicated.....by Mr Smith.....whose son had sent them from Buenos Ayres." (E, holo.).

Erect, often spindly, tree-like shrub to 6 m high, with 1 or a few main woody stems; stems often tinged bluish. *Indumentum* a few eglandular trichomes on new growth, bracts, pedicels and calyx; other parts glabrous. *Leaves* rubbery, glaucous, petiolate; *lamina* (1-)2-13(-23)cm long x (0.5-)1-7(-17)cm wide, ovate or elliptic, occasionally narrowly or widely so (rarely obovate); apex obtuse to broad-acuminate; base obtuse to cuneate or narrow-cuneate; margin entire or slightly sinuate; *petiole* (0.5-)1-6(-12)cm long, terete, or narrowly winged near base of lamina, insertion onto stem simple.

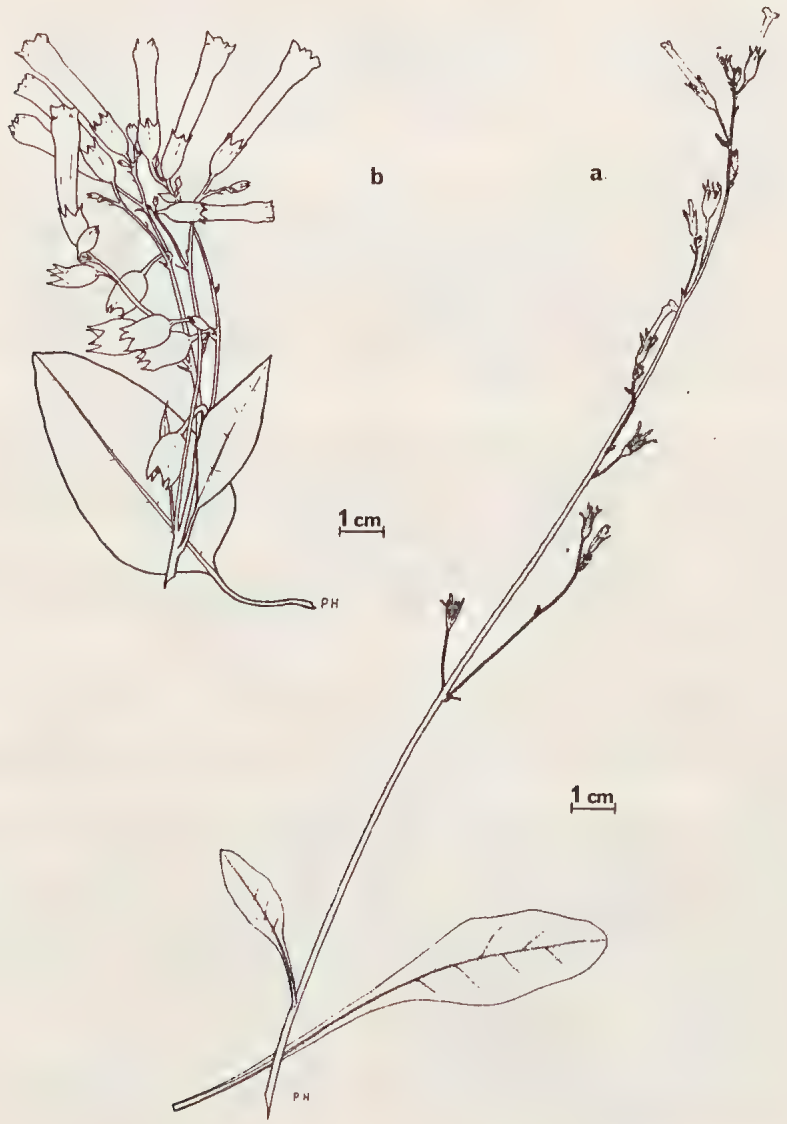


Fig. 13. (a) *Nicotiana rotundifolia*, voucher *Hj. Eichler 20174* (PERTH); (b) *N. glauca*, voucher *D.E. Symon 7294* (ADW).

Inflorescence a short, dense, terminal panicle; *bracts* 2-7(-18) mm long, lanceolate to linear-lanceolate; *pedicels* to 15 mm long and curved or reflexed in fruit. *Calyx* 7-14 (-17) mm long; sepals narrow-elliptic or elliptic-lanceolate, equal to subequal, fused for $^2/_3$-$^7/_8$ their length; intersepalar membranes inconspicuous. *Corolla* yellow or yellowish; *corolla tube* (19-)21-40 mm long, (2.5-3-5(-6.5) mm wide at top of calyx; tube proper fairly distinctly narrower than throat cylinder; throat cup not very distinct, symmetrical; *corolla limb* 8-13 mm diameter, remaining open in sunlight, lobes obtuse, fused for $^2/_3$ to almost all their length. *Stamens* all level or nearly so, their anthers near top of throat cup; *filaments* 19-29 mm long, all inserted onto corolla in proximal $^1/_2$ of tube. *Capsule* 7-13 mm long, equalling or slightly shorter than calyx, ellipsoid to ovoid-ellipsoid or widely so, occasionally suborbicular (length:breadth 3:2, occasionally 1:1, rarely 2:1). *Seeds* 0.5-0.9 mm long, reniform to triangular- or oblong-reniform; testa honeycombed or with elongate honeycombs or wrinkles. (Fig. 13b).

Chromosome number: n = 12 (Goodspeed, 1954:336).

Distribution and habitat

N. glauca is considered to be a native of Argentina but has become widespread in many warm temperate regions of the world, including Australia. In Australia it occurs throughout south-eastern Queensland, most of New South Wales and Victoria, in Northern Territory south of Alice Springs, south-eastern and central South Australia, and in Western Australia around Perth and Geraldton and scattered in southern regions (Fig. 15). It grows in open and disturbed areas including creeklines, roadsides and waste-land, in a wide variety of soil types.

Notes

N. glauca has become well established in widespread regions of Australia, having been introduced at quite an early date. For instance in about 1847 it was apparently brought from Melbourne to Adelaide by Mr F.M. Dutton and "one box given to Bailey's Hackney Nursery" (J. Bureau Agric., 6:160 [1893]).

In Australia, *N. glauca* may flower at any time throughout the year. Occasional hybrids have apparently occurred between some endemic species and *N. glauca* (see section on hybrids).

Selected specimens (total seen about 329)

WESTERN AUSTRALIA: *T.E.H. Aplin 1490*, 34 km south of Geraldton, 23.v.1962 (PERTH); *L. Haegi 918*, base of Mt Charlotte, Kalgoorlie, N.E. side, 12.ix.1976 (AD).

NORTHERN TERRITORY: *S.A. Parker 169*, Finke River, 3 km west of Horseshoe Bend Homestead, 2.v.1970 (NT).

QUEENSLAND: *L. Durrington 511*, Serpentine Creek and environs, ca 11 km N.E. of Brisbane, Dec. 1972 (BRI); *J. Ebersohn 259*, Wittenburra Station, 39 km south of Eulo, 9.x.1962 (BRI); *N.H. Speck 2009*, 14 km north of Wowan, 17.v.1964 (BRI, CANB).

NEW SOUTH WALES: *S. Jacobs 1923*, Sandstone Paddock, Fowlers Gap, 18.x.1974 (NSW); *E.J. McBarron 3071*, stock route, Henty, 15.ii.1949 (NSW); *J.C. deNardi 1025*, ca 35 km N.W. of Euston, 16.x.1972 (NSW); *J. Pickard 3138*, Depot Glen, 12 km north of Milparinka, 30.x.1976 (NSW); *A. Rodd 1883*, 18 km south of Bourke on Cobar Road, 4.xi.1971 (NSW); *K.L. Wilson 1612*, Marlow, 22 km north of Conoble Railway Station, 23.x.1976 (NSW).

VICTORIA: *H.I. Aston 545*, Lake Bael Bael, 9.ii.1960 (MEL); *E.M. Canning 2985*, 8 km from Jeparit, towards Nhill, 11.xi.1969 (ADW, MEL).

SOUTH AUSTRALIA: *D.E. Symon 8333*, Lake Acraman, 3.x.1972 (ADW); *11448*, Andamooka, 22.x.1978 (ADW); *J.R. Wheeler 444*, Chowilla Station, 17.ix.1967 (AD); *D.J.E. Whibley 5477*, Mt Mambray, 9.i.1975 (AD); *L.D. Williams 1596*, Meningie, 19.i.1962 (AD); *P.G. Wilson 1689*, 1 km N.W. of Cook, 16.ix.1960 (AD).

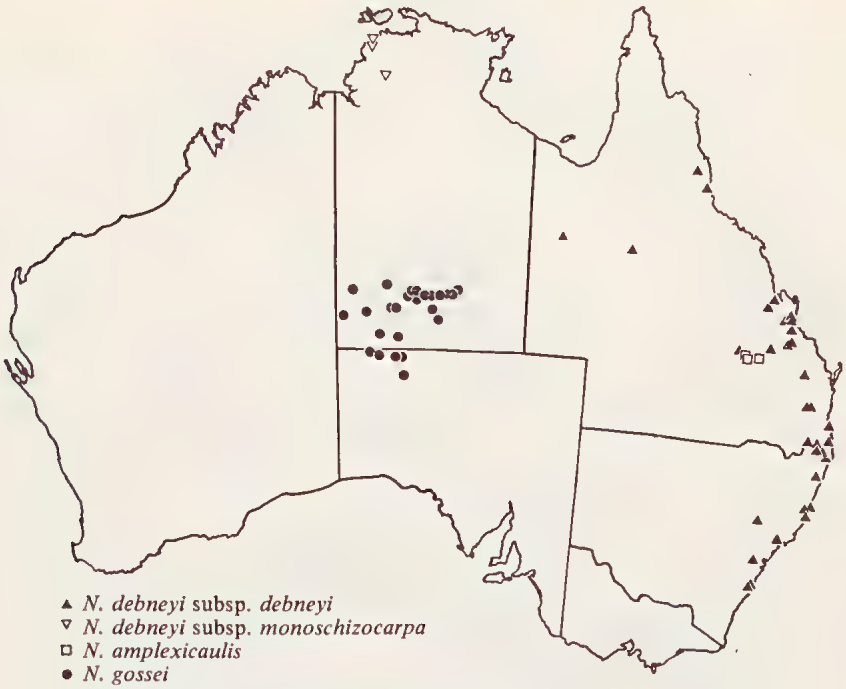


Fig. 14. Distribution of *Nicotiana* in Australia.

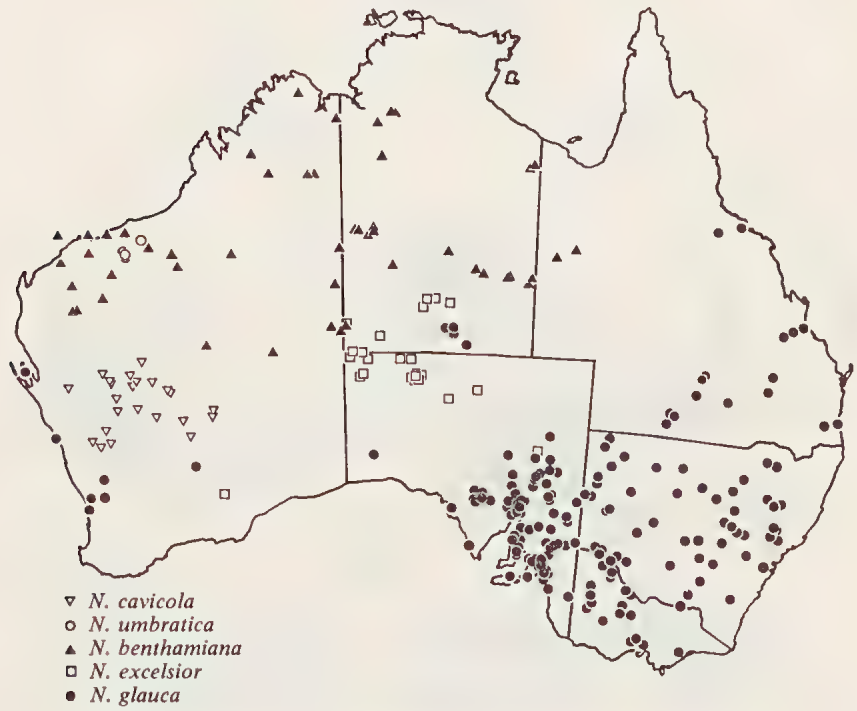


Fig. 15. Distribution of *Nicotiana* in Australia.

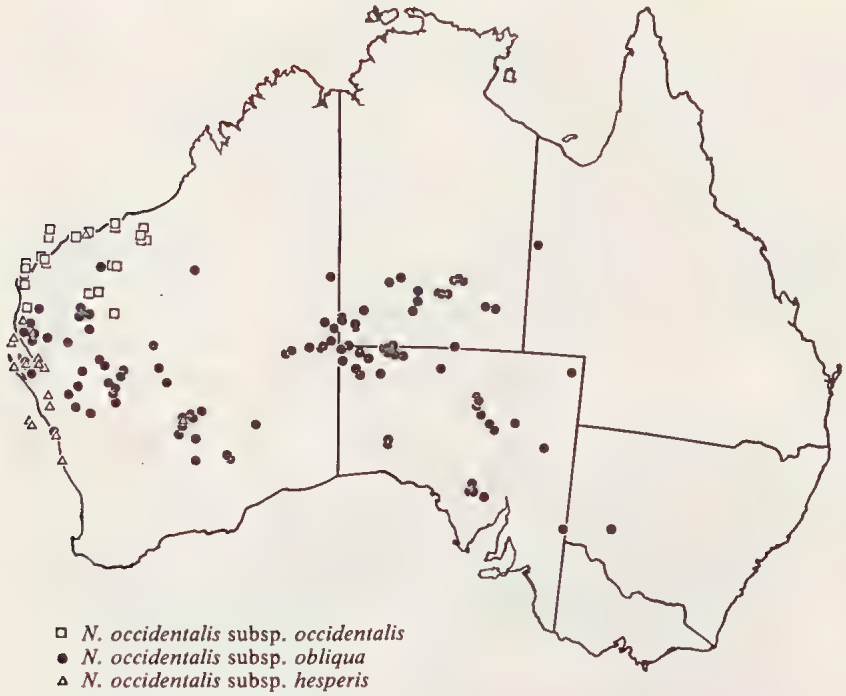


Fig. 16. Distribution of *Nicotiana* in Australia.

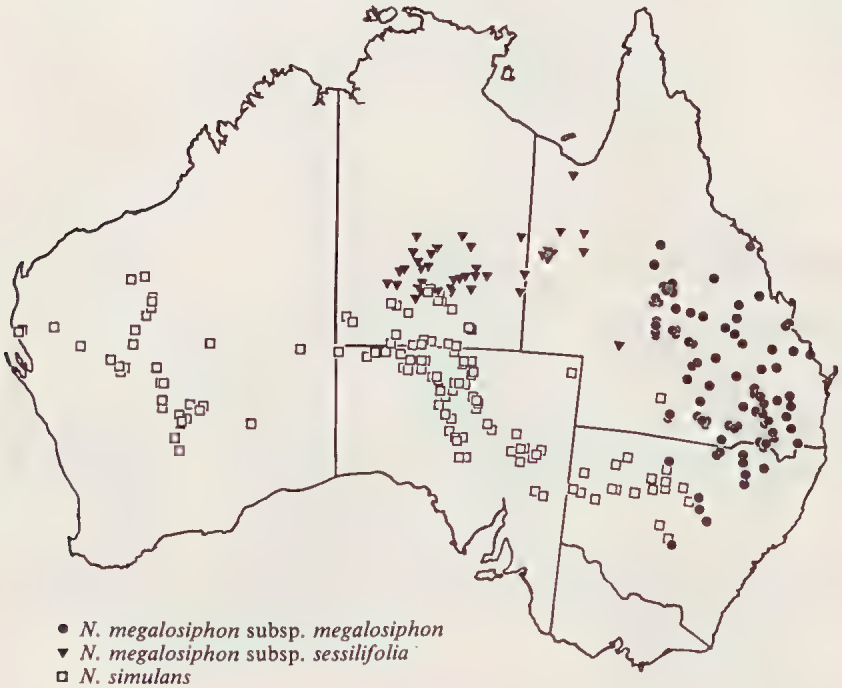
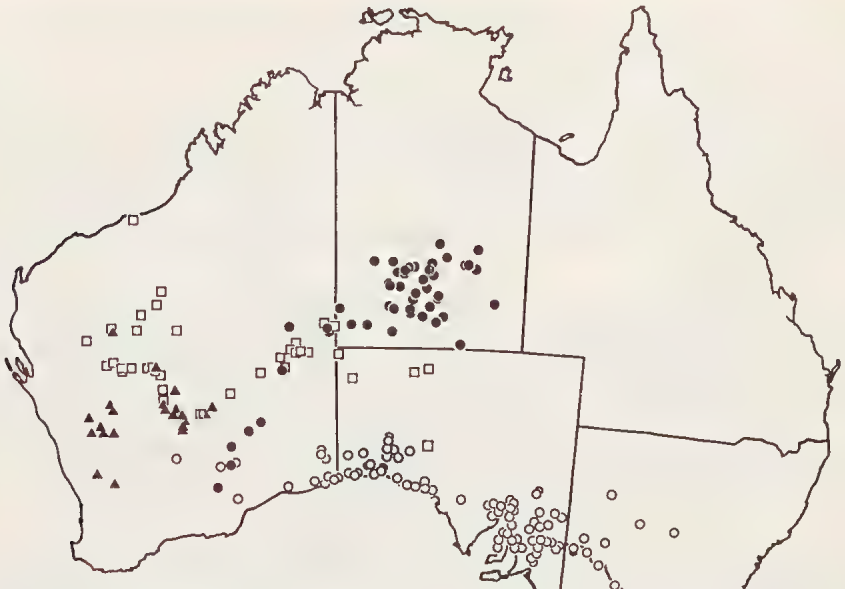


Fig. 17. Distribution of *Nicotiana* in Australia.



▲ *N. rosulata* subsp. *rosulata* (with shorter corolla)
□ *N. rosulata* subsp. *rosulata* (with longer corolla)
● *N. rosulata* subsp. *ingulbà*
○ *N. goodspeedii*

Fig. 18. Distribution of *Nicotiana* in Australia.

▲ *N. suaveolens*
□ *N. maritima*
● *N. velutina*
▽ *N. rotundifolia* (corresponding with subsp. *rotundifolia* of Burbidge [1960]).
○ *N. rotundifolia* (corresponding with subsp. *aridicola* of Burbidge [1960])
■ *N. rotundifolia* (not corresponding with either of Burbidge's subspecies)

Fig. 19. Distribution of *Nicotiana* in Australia.

Alien species cultivated in Australia

N. tabacum L., Sp. Pl. 1:180 (1753).

Leafy, viscid annual or short-lived perennial about 1-3 m high. *Leaves* almost all cauline, petiolate (uppermost sub-petiolate), elliptic or ovate to lanceolate; *petiole* winged, somewhat auriculate and decurrent down stem. *Inflorescence* a fairly short, dense panicle. *Corolla* whitish to pink; tube (30-)35-55 mm long; tube proper shorter and distinctly narrower than throat cylinder; throat cup distinct; *corolla lobes* acute to acuminate. *Filaments* of upper 4 stamens long, that of fifth slightly shorter, all inserted at base of throat cylinder.

N. tabacum is the major species in commercial tobacco production, in Australia as well as elsewhere. Almost no collections have been noted of this species which were definitely naturalized, so it appears that *N. tabacum* has hardly moved beyond cultivation in Australia. A collection of an apparently spontaneous plant is: *K.L. Wilson 638*, Royal Botanic Gardens, Sydney, New South Wales, 25.x.1974, "On site cleared for new succulent garden" (NSW) (apparently *N. tabacum* does occur sparingly as a weed in most parts of the gardens; L. Haegi, pers. comm. 1980). Another is: *R.V. Southcott s.n.*, Phillip St, Sydney, New South Wales, 18.iii.1960, "On vacant land" (AD 966071444).

N. alata Link & Otto, Ic. Pl. Rar. Hort. Reg. Bot. Berol. 1:63, tab. 32 (1828).

Leafy, viscid, short-lived perennial herb about 1-1.5 m high. *Leaves* mostly cauline, basal ones petiolate, those above becoming sessile and decurrent down stem, elliptic or ovate, uppermost lanceolate; *petiole* winged, stem-clasping or decurrent. *Inflorescence* racemose. *Corolla* white, tinged greenish outside, and at least in cultivation the limb may be purplish-pink; *tube* 50-100 mm long; tube proper longer than and not very distinct from throat cylinder; throat cup fairly distinct; *corolla lobes* acute. *Filaments* of upper 4 stamens fairly long, that of fifth slightly shorter, all inserted at base of throat cylinder.

This South American species is widely grown in cultivation as an ornamental plant. In Australia it does not appear to have extended beyond cultivation; I have seen no field collections of it from Australia.

N. sylvestris Spegazzini & Comes in Comes, Monogr. Nicot.:34 (1899).

Leafy, viscid perennial herb about 1-2 m high. *Leaves* both radical and cauline, basal leaves petiolate, upper ones subsessile to sessile, elliptic, upper ones elliptic to ovate; base auriculate on sessile leaves; *petiole* winged, stem-clasping. *Inflorescence* a short, dense panicle. *Corolla* white, *tube* spindle-shaped, 65-85 mm long; tube proper shorter than and not very distinct from throat cylinder; throat cup indistinct; *corolla lobes* acute or acuminate. *Filaments* of upper 4 stamens long, that of fifth slightly shorter, all inserted at base of throat cylinder.

Although no Australian field collections of *N. sylvestris* (an Argentinian species) were seen, it is at least grown as an ornamental garden plant. Three such garden collections were noted:

H.C.D. Barker s.n., Kadina, S. Aust., March 1978 (AD 97817173); *J. Chraska s.n.*, West Hobart, Tas., *s.dat.* (HO 30551); *D.E. Symon 10975*, American River, Kangaroo Island, 24.i.1978 (ADW).

Names insufficiently known

N. anisandra Vest, Flora 4:147 (1821) (no collection data given; Goodspeed (1954) suggested it may be synonymous with *N. suaveolens*).
N. australasiae R.Br. in Tuckey, Narr. Exped. R. Zaire, etc. app. 5:472 (1818), *nom. nud.*, a synonym of *N. suaveolens* according to Domin (1929) and Goodspeed (1954).

N. australis R.Br. in Comes, Monogr. Nicot.:41 (1899), *nom. nud.* Domin (1929) cites a specimen under this name (for which he gives no description): *Victorian Exploring Expedition s.n.*, Duroodoo, *s.dat.* (K *s.n.*-photo. in ADW), which in fact appears to be *N. velutina.*

N. mirabiliflora Dietr. in Comes, Monogr. Nicot.: 39 (1899), *nom. nud.*? I can find no earlier reference to this name than in Comes (1899), who treats it as a synonym of *N. suaveolens.*

N. odorata hort. ex Donn, Hortus Cantabrig. (1819) (n.v.; not listed in the 1845 edition. Goodspeed (1954) quoted it as originating from Australia and suggested it might be synonymous with *N. suaveolens).*

N. suaveolens var. **anisandra** (Vest) Comes, Monogr. Nicot.: 42 (1899).

N. suaveolens var. **longiflora** Benth., Fl. Austral. 4:470 (1868), a synonym of *N. megalosiphon* according to Domin (1929) and Goodspeed (1954). Bentham described it as "Corolla-tube at least 2in. long. Leaves various.—In the interior of Queensland and N.S.Wales." so it is unlikely to be anything other than *N. megalosiphon.* No type specimen of this variety was cited, and none at K is annotated.

N. suaveolens var. **parviflora** Benth., Fl. Austral. 4:470 (1868). No type specimen was cited, and none at K is annotated.

N. suaveolens var. **vincaeflora** (Lag. ex Link) Comes, Monogr. Nicot.:42 (1899). Comes suggested that it may have originated "from New Holland".

N. vincaeflora Lag. ex Link, Enum. Hort. Berol. 1:179 (1821). Goodspeed (1954) suggested this may be a synonym of *N. suaveolens* or *N. plumbaginifolia* Viviani, the latter a South American species.

Excluded names

N. obtusisepala Domin, Biblioth. Bot. 89:1147, pl.36 fig.1 (1929).

Type: *Domin 8324*, Hughenden, Qld, Feb. 1910 (PR-photo. in ADW). This appears to be a *Petunia*; Goodspeed (1954) considered it to be *P. axillaris* (Lam.) B.S.P.

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I am especially grateful to Mr D.E. Symon for his generous help and advice given to me throughout this study.

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Index to Collections

amp	= *N. amplexicaulis*	megs	= *N. megalosiphon* subsp. *sessilifolia*
ben	= *N. benthamiana*	occ	= *N. occidentalis*
cav	= *N. cavicola*	occh	= *N. occidentalis* subsp. *hesperis*
deb	= *N. debneyi*	occob	= *N. occidentalis* subsp. *obliqua*
debd	= *N. debneyi* subsp. *debneyi*	occoc	= *N. occidentalis* subsp. *occidentalis*
debm	= *N. debneyi* subsp. *monoschizocarpa*	ros	= *N. rosulata*
exc	= *N. excelsior*	rosi	= *N. rosulata* subsp. *ingulba*
gl	= *N. glauca*	rosr	= *N. rosulata* subsp. *rosulata*
good	= *N. goodspeedii*	rot	= *N. rotundifolia*
gos	= *N. gossei*	sim	= *N. simulans*
mar	= *N. maritima*	suav	= *N. suaveolens*
meg	= *N. megalosiphon*	umb	= *N. umbratica*
megm	= *N. megalosiphon* subsp. *megalosiphon*	vel	= *N. velutina*

In each case the collector's name is given, followed by the collector's number and then the species collected (abbreviations for which see above). If a collection has no collector's number, then the date of collection is given. Collections are separated by semi-colons, and collectors by dashes. "T" denotes a type collection.

L. Abrahams s.n., ix.1910/vel—Adams 1367/megm—C. Adams 15/megm; 31/megm—P. Aitken s.n., 10.xii.1964/vel—C.R. Alcock 922/mar; 986/mar; 1095/mar; 2633/mar; 3582/vel; 4099/gl; 4219/vel—C.E.F. Allen 630/gos—G.H. Allen 281/vel; 678/gl—G.O. Allen s.n., v. 1923/gl—Amstberg s.n., 4.ix.1969/vel—G.W. Anderson s.n., 23.x.1969/vel—H.G. Andrewartha s.n., 27.iv.1938/sim—Mrs Andrewartha s.n., v.1938/vel—B.G. Andrews 8/sim—C. Andrews s.n., xi.1901/rot; s.n., x.1903/rot—C.R. Andrews 1221/rot—E.C. Andrews s.n., xii.1917/gl—J.C. Anway 471/gl—T.E.H. Aplin s.n., 2.ix.1962/good; B2/sim; 1490/gl; 1694/good; 1715/good; 1757/rot; 2296/occh; 2334a/rosr; 2364/rosr; 2381/rosr; 2456/rosr; 2485/sim; 2499/sim; 2528/cav; 2532/occob; 2577/rot; 3201/occh; 3207/occh; 3295/occob; 3327/gl—Aquinas College Expedition M8/occh—J.M. Arthur s.n., 5.x.1949/debd—A.M. Ashby 2242/occob & sim; 2614/cav; 2943/occoc; 3312/rosr; 3566a/occob & rosr; 3566b/rosr; 3992/ben—D. Ashton s.n., viii-ix.1961/vel—H.I Aston 545/gl.

E.T. Bailey 406/rot—J.F. Bailey s.n., 25.xi.1896/vel; s.n., xii.1896/gl—K.C. Baker 860/megm; 905/megm—J. Baldwin Spencer s.n., ix.1903/sim—S. Barker 15/good; 60/gl—S. Barker & T. Fatchen 21/sim—W.R. Barker 7/gl; 11/good; 360/gl; 391/vel; 2078/ben; 2680/megs; 2681/megs; 3001/occob; 3023/exc; 3118/occob; 3200/vel; 3271/occob; 3371/rosr; 3372/sim; 3470/sim; 3471/occob; 3489/sim; 3512/vel; 3539/sim—R.S. Barnes s.n., 21.viii.1972/vel—W. Barton s.n., 1867/megm—H. Basedow s.n., vii.1926/sim; 211/occob; 350/occob;

390/occob—J.D. Batt s.n., 1889/good; s.n., 1886/good—N.C. Beadle s.n., ix.1939/good; s.n., 2.ii.1946/gl; s.n, viii.1948/gl; s.n., viii.1955/gl—J.S. Beard 2642/rosr; 2876/occoc; 6085/occob—A.C. Beauglehole 1065/gl; 2075/vel; 2085/mar; 3603/debd; 7473/vel; 8834/gl; 9845/gl; 10137/exc; 10179/exc; 10256/vel; 10272/vel; 10275/gos; 10288/vel; 10317/vel; 10323/vel; 10534/vel; 11348/ben; 11381/occ; 11428/sim; 11525/occoc; 11567/occoc; 11741/occh; 13146/rot; 13394/good; 13421/good; 20016/vel; 20092/sim; 20281/ros; 20282/gos; 20283/rosi; 20456/rosi; 20602/occob & vel; 20838/vel; 22884/gos; 22937/exc; 23039/ros; 23049/gos; 23259/rosi; 23268/gos; 23269/vel; 23434/vel; 23435/ros; 23436/gos; 23437/rosi; 23731/vel; 23860/gos; 24241/occob; 24426/megs; 25480/exc; 25632/sim; 25944/sim; 25978/gos; 26302/gos; 26303/sim; 26338/gos; 26563/rosi; 27910/vel; 27958/vel; 28156/gl; 28813/vel; 29152/vel; 29861/gl; 33124/suav; 39878/gl; 40432/suav; 40497/good; 44514/vel; 44532/vel; 44664/megs; 44718/megs; 44719/megs & occob; 44723/vel; 44841/megs; 44851/vel; 44952/gos; 44974/gos; 45020/vel; 49067/occob; 49473/good; 50887/ben; 55637/gl; 55985/good; 56068/gl; 56124/vel; 57931/rosi; 58050/vel; 58083/megs; 59570/rosr; 59571/occob; 59760/rosr; 59766/sim; 59897/sim; 60123/rosr; 60200/occob; 60245/occob; 60268/occob; 60546/ben; 60673/rosi; 60727/ben; 60856/rosi—J.M. Bechervaise s.n., 25.viii.1947/vel; s.n., 10.ix.1947/sim—Beckwith s.n., viii.1915/vel—R. & R. Belcher 32/vel; 82/exc; 286/gl; 287/good—R. Bennett s.n., x.1935/vel—D.M. Benson & J. Pickard 1850/gl—R. Berryman s.n., ii.1960/megm—E. Beythien s.n., 1890/good—E.W. Bick s.n., i.1917/gl—C.W. Birch s.n., 1871/megm; s.n., 1884/megm—E.C. Black s.n., x.1923/vel; s.n., viii.1936/megs; s.n., iii.1937/vel; s.n., 12.x.1938/mar; s.n., iv.1941/good; s.n., x.1947/vel—W.E. Blackall, s.n., ix.1939/rosr; 3813/rot; 4094/rot; 4682/occob—S.T. Blake 7627/megm; 10062/megm; 10561/vel; 10599/vel; 10647/vel; 11173/megm; 11184/vel; 11527/ben; 11651/megm; 11652/megm; 11765/vel; 11964/vel; 12222/vel; 12245/vel; 12315/vel—W.F. Blakely s.n., x.1899/suav; s.n., vii.1928/suav—B.J. Blaylock 1240/mar; 1771/mar; 2077/good; 2090/good—D.F. Blaxell 593/vel—J.V. Blockley 989/ben—P.M. Blundell s.n., v.1911/megm—E.F. Boehm s.n, ix.1942/good; 385/good; 386/good—C.D. Boomsma 45B/exc—J.L. Boorman s.n., ix.1904/suav; s.n., x.1906/sim; s.n., vi.1907/gl; s.n., viii.1908/gl; s.n., x.1909/debd; s.n., ii.1911/suav; s.n., viii.1912/debd; s.n., x.1912/gl & vel; s.n., xii.1918/gl—E.J. Booth s.n., 19.ii.1947/gl; G.A. Borthistle s.n., iii.1919/suav—P. Boswell R21/rot—D.L. Boyland 276/vel; 3085/vel—E. Breakwell s.n., viii.1913/gl—B.G. Briggs 1155/megm; 1231/vel; 2284/suav; 4292/megm; 4629/vel—Brooke s.n., xii.1884/rot; s.n., 1886/good—G.B. Brooks s.n., xi.1917/gl; s.n., 13.xi.1934/debd—R. Brooks s.n., xi.1954/gos—Broome s.n., xi.1940/gl—P. Brough s.n., 24.viii.1939/gl & sim—C. Brown s.n., 16.vii.1958/rosi—E.R. Brown s.n., ii.1897/debd—J.S. Brownes s.n., 1875/mar—R. Brummit s.n., 29.ix.1892/vel—N.T. Burbidge s.n., viii.1930/good; s.n., 28.viii.1946/good; s.n., 18.ix.1955/gos; s.n., xii.1955/rot; 202/occob; 204/rot; 1021/occ; 1048/umb; 1077/occoc; 1191/ben; 1225/rosr; 1251/occ; 1335/rosr; 2622/rot; 2668/rot; 4177/sim; 4201/vel; 4202/vel; 4203/megs; 4242/vel; 4256/vel; 4259/rosi; 4263/vel; 4267/vel; 4272/vel; 4341/rosi; 4369/vel; 4370/megs; 4371/megs; 4373/rosi; 4374/rosi; 4495/occob & sim or meg; 4502/vel; 4508/vel; 4509/vel; 4533/vel; 4561/vel; 4590/sim; 4606/sim; 4625/sim T; 4635/sim; 4652/vel; 4671/good; 4853/occob; 4881/rot; 4989/rot; 4990/rot; 5464/megm; 5467/megm; 5477/megm; 5481/megm; 5482/megm; 5484/megm; 5485/megm; 5486/megm; 5487/vel; 5488/megm; 5489/vel; 5490/vel; 5492/vel; 5494/vel; 5495/vel; 5496/meg; 5498/megm; 5499/vel; 5500/vel; 5501/vel; 5502/megm; 5504/megm; 5505/megm; 5509/megm; 5511/megm; 5512/megm; 5513/megm; 5516/megm; 5518/megm; 5522/megm; 5524/megm; 5525/megm; 5528/megm; 5545/megm; 5548/megm; 5552/megm; 5555/megm; 5556/megm; 5560/amp; 5561/debd; 5562/amp T; 5565/megm; 5566/megm; 5567/megm; 5571/vel; 5572/vel; 5573/vel; 5578/vel; 5579/megm; 5580/megm; 5587/megm; 5588/megm; 5589/megm; 5590/megm; 5820/umb; 5873/umb; 5957/umb; 6031/sim; 6068/sim; 6079/rosr; 6082/sim; 6090/sim; 6421/suav; 6422/suav; 6443/occh; 6445/occh; 6451/occh; 6455/occh; 6461/occh; 6473/occh; 6480/occh; 6485/occh; 6486/occh; 6493/occob; 6494A/occh T; 6494B/occob; 6507/occh; 6519/occh; 6593/sim; 6596/sim; 6598/sim; 6603/ sim; 6625/vel; 6635/vel; 6636/vel; 6638/vel; 6642/vel; 6643/vel; 6651/suav; T.S.6/debd; T.S.9/suav; T.S.28/megm; T.S.33/vel; T.S.41/suav; T.S.45/suav; T.S.46/suav; T.S.47/suav; T.S.49/gos; T.S.53/exc; T.S.54/megm; T.S.55/good; T.S.56/debd; T.S.57/megm; T.S.58/megm; T.S.61/megm; T.S.64/exc; T.S.65/exc; T.S.67/megm; T.S.70/vel; T.S.71/gos; T.S.72/exc; T.S.73/exc; T.S.74/gos; T.S.75/rosi; T.S.76/vel; T.S.77/gos; T.S.78/gos; T.S.79/exc; T.S.80/gos; T.S.85/vel; T.S.87/ben; T.S.90/suav; T.S.93/gos; T.S.94/rosi; T.S.95/exc; T.S.96/vel; T.S.98/debd; T.S.99/mar; T.S.100/good; T.S.102/rot; T.S.103/rot; T.S.104/gos; T.S.105/exc; T.S.106/good; T.S.107/mar; T.S.110/megm; T.S.111/amp; T.S.112A/vel; T.S.115/good; T.S.118/gos; T.S.119/debd; T.S.120/debd; T.S.121/debd; T.S.123/rosi; T.S.124/vel; T.S.125/vel; T.S.126/vel; T.S.127/vel; T.S.129/vel; T.S.130/sim & vel; T.S.131/vel; T.S.136/sim; T.S.137/sim; T.S.138/sim; T.S.139/ben; T.S.140/vel; T.S.141/vel; T.S.142/vel; T.S.143/vel; T.S.144/vel; T.S.145/vel; T.S.146/vel; T.S.147/vel; T.S.148/sim & vel; T.S.148A/vel; T.S.149/vel; T.S.150/vel; T.S.151/vel; T.S.152/vel; T.S.154/megs; T.S.155/rosi; T.S.157/megs; T.S.158/megs; T.S.159/megs; T.S.160/occob & sim; T.S.161/sim; T.S.162/sim; T.S.163/sim; T.S.164/sim; T.S.164a/vel; T.S.167/megs; T.S.168/good; T.S.169/rot; T.S.170/sim; T.S.171/sim; T.S.172/sim; T.S.173/cav; T.S.174/rosr; T.S.175/sim; T.S.176/occob; T.S.177/sim; T.S.178/rosr; T.S.179/cav & sim; T.S.179a/cav; T.S.181/occob; T.S.182/sim; T.S.183/rosr & sim; T.S.184/rosr; T.S.185/rosr; T.S.186/sim; T.S.187/sim; T.S.188/sim; T.S.189/rosr; T.S.190/rosr; T.S.191/sim: T.S.192/sim; T.S.193/rot; T.S.194/rot; T.S.195/rot; T.S.196/rot; T.S.196a/rot; T.S.197/rot; T.S.198/occob; T.S.199/rot; T.S.200/cav; T.S. 201/cav; T.S.202/cav T; T.S.203/cav; T.S.204/cav; T.S.205/cav; T.S.206/cav; T.S.207/cav; T.S.208/sim; T.S.211/rosr; T.S.213/rosr; T.S.214/sim; T.S.215/cav; T.S.216/sim; T.S.217/rosr; T.S.218/rosr; T.S.219/sim; T.S.221/rosr; T.S.222/good; T.S.231/megm; T.S.232/debd; T.S.233/debd; T.S.234/occ; T.S.235/rot; T.S.236/occob; T.S.237/gos; T.S.238/sim; T.S.239/vel; T.S.240/megm; T.S.241/megm; T.S.242/megm; T.S.243/megm;

T.S.244/megm; T.S.245/megm; T.S.246/megm; T.S.247/megm; T.S.248/megm; T.S.249/megm; T.S.250/vel; T.S.251/vel; T.S.252/vel; T.S.253/vel; T.S.254/vel; T.S.255/vel; T.S.256/vel; T.S.260/vel; T.S.261/vel; T.S.262/megm; T.S.263/megm; T.S.264/megm; T.S.265/megm; T.S.266/megm; T.S.267/megm; T.S.268/megm; T.S.269/megm; T.S.271/megm; T.S.274/vel; T.S.276/gos; T.S.277/sim; T.S.278/vel; T.S.280/vel; T.S.281/megm; T.S.282/vel; T.S.285/megm & vel; T.S.287/debd; T.S.289/cav; T.S.290/occob; T.S.291/occob; T.S.293/suav; T.S.294/rot; T.S.297/vel; T.S.298/umb; T.S.299/ben; T.S.301/umb; T.S.302/umb; T.S.303/umb; T.S.304/umb; T.S.305/umb; T.S.306/sim; T.S.307/sim; T.S.308/rosr; T.S.309/sim; T.S.310/sim; T.S.311/sim; T.S.312/sim; T.S.313/rosr; T.S.314/sim; T.S.315/sim; T.S.316/sim; T.S.318/ben; T.S.319/ben; T.S.320/sim; T.S.321/occob; T.S.322/umb; T.S.324/suav; T.S.326/sim; T.S.337/occh—G. Burkitt s.n., s.dat/megm—R. Butler 19/ben—W.H. Butler s.n., viii.1957/occh; s.n., 20.viii.1960/rosr; s.n., i.1962/rosi; 22/occoc—Bynoe s.n., NW. coast, Australia, s.dat/ben T; s.n., Bezout Island, s.dat./ben—P.M. Byrne s.n., 1887/sim.

R.A. Callen 17/vel—E.M. Canning 2171/gl; 2985/gl—F.S. Carey s.n., viii.1884/occh; s.n., 1884/occ; s.n., 1978/occoc—W.M. Carne s.n., 2.iii.1910/debd; s.n., ii.1913/gl—R.C. Carolin 343/vel; 670/vel; 974/debd; 1952/suav; 3257/occh; 5253/rosi; 5292/occob; 5387/rosi; 6088/rosr; 6123/ben; 6143/ben; 6232/ben; 6290/ben; 7596/occoc; 7742/occoc; 7881/occ—G.W. Carr 1322/gos; 1463/vel; 1511/megs; 1521/gos; 1569/gos; 1821/gos; 1828/sim; 2092/vel; 2106/gos; 2136/gos; 2427/megs & vel; 2901/ben; 2964/ben; 4284/ben; 4292/ben; 4927/ben; 5046/ben—J. Carrick 1799/good; 1893/vel; 2061/vel; 2062/occob; 2362/gl; 2379/occob; 3582/mar; 3804/mar—B.B. Carrodus s.n., s.dat./gl; s.n., ix.1956/vel—A. & D. Carson s.n., iii.1887/megm—H. Carter s.n., 1883/suav—F.L. Cavenagh s.n., ix.1933/gos—P. Cawthorn 59/good—R.O. Chalmers and H.J. de S. Disney s.n., 16.vi.1967/vel—M. Chamberlain s.n., 4.i.1915/gl—L. Chandler s.n., 18.xii.1962/good—D. Chapman s.n., s.dat./ben—E. Cheel s.n., 1.xii.1919/suav; s.n., 24.xi.1929/suav—J.W. Chigwidden s.n., 17.vi.1970/gl—R.J. Chinnock 44/gl; 377/vel; 605/ros; 611/ros; 894/ben; 993/ros; 1027/cav; 1184/good; 1522/vel; 1539/good; 1540/gl; 1548/good—G. Chippendale (all collections s.n., NT herbarium numbers given) NT423/vel; NT545/vel; NT692/rosi; NT723/vel; NT1291/megs; NT1299/vel; NT1304/gl; NT1364/sim; NT1569/rosi; NT1615/vel; NT1768/rosi; NT1799/ben; NT2020/rosi; NT2115/vel; NT2644/vel; NT2652/vel; NT2767/rosi; NT2832/vel; NT3492/vel; NT3589/vel; NT3622/gos; NT3648/vel; NT4550/ben; NT4754/megs; NT4888/vel; NT4968/vel; NT6462/rosi; NT6639/vel; NT7387/vel; NT7407/vel; NT7436/rosi—G. Chippendale & E.F. Constable s.n., 20.v.1951/gl—R.E. Choncellor s.n., 10.viii.1961/vel—P.J. Clark 3/good—G.H. Clarke s.n., 22.ix.1936/good—J.B. Cleland (all collections s.n.) 26.xi.1913/good; 21.i.1927/mar; 11.viii.1929/vel; viii.1930/vel; 26.i.1932/mar; 22.v.1932/mar; viii.1932/exc; 11.viii.1932/occob; 16.viii.1932/gos & rosi; 23.viii.1932/vel; ix.1932/mar T; 1.x.1932/gl; 28.x.1932/mar; 12.xi.1932/mar; 7.viii.1933/sim; 13.viii.1933/gos; 16.viii.1933/exc; 19.viii.1933/occob; 20.x.1933/mar; 30.x.1933/mar; 14.viii.1934/vel; 19.viii.1934/vel; 28.i.1935/suav; 29.v.1935/sim; 1.vi.1935/vel; 18.vi.1935/rosi; 21.ix.1935/mar; 13.i.1936/mar; 30.v.1936/vel; 9.viii.1936/gos, megs & occob; 13.viii.1936/ben; 20.viii.1936/ben; 24.viii.1936/vel; 3.xi.1936/good; 5.xi.1936/good; 26.v.1937/vel; 31.v.1937/vel; 14.viii.1937/vel; 4.ix.1941/vel; 17.xii.1941/mar; 12.ii.1942/good; 19.vii.1943/gl; 1.ix.1944/good; 25.ix.1944/sim; 29.viii.1945/exc; 23.ix.1945/sim; 24.ix.1945/occob; 25.ix.1945/sim; 27.ix.1945/exc & vel; 28.ix.1945/occob; 29.ix.1945/sim; 8.v.1946/good; 6.vi.1946/good; 28.viii.1946/vel; 11.iv.1950/exc; 12.iv.1950/exc; 28.viii.1950/vel; 21.ix.1950/good; 14.viii.1951/sim; 19.viii.1951/rosi; 22.iii.1952/mar; 15.x.1953/mar & good; 17.x.1953/good; 20.x.1953/good; 28.x.1953/mar; 11.xi.1953/mar; 21.xi.1953/mar; 15.vi.1954/vel; 19.vii.1954/good; 16.vii.1954/rosr & vel; 17.viii.1954/exc, occob & vel; 19.viii.1954/occob & sim; 24.viii.1954/occob; 28.viii.1954/gos; 1.ix.1954/exc; 4.x.1954/vel; 6.x.1954/good; 9.x.1954/good; 10.x.1954/occob; 21.iv.1955/vel; 12.xi.1955/good; 15.viii.1956/megs; 26.viii.1956/megs & rosi; 30.viii.1956/vel; 14.ix.1956/good; 16.ix.1956/vel; 21.ix.1956/vel; 13.i.1957/mar; 15.viii.1957/megs & vel; 28.viii.1957/rosi; 30.viii.1957/megs; 1.ix.1957/rosi & vel; 4.ix.1957/rosi; 7.ix.1957/vel; 17.ix.1957/good; 26.v.1958/good; 21.vi.1958/ben; 28.vi.1958/exc; 10.iii.1960/good; 23.vi.1960/occob; 26.vi.1960/occob & rosr; 2.vii.1960/gos; 3.vii.1960/exc; 10.xi.1960/mar; 7.vii.1961/good; 28.ix.1961/vel; 8.iii.1962/good; 26.i.1963/mar; 26.v.1963/sim; 12.xi.1964/vel; 18.ix.1965/mar; 26.viii.1966/vel; 10.ix.1966/mar; 27.iii.1967/mar; 21.ix.1968/good; 28.ix.1968/mar—M.S. Clemens s.n., 26.ix.1945/megm; s.n., April 1946/megm; s.n., Sept. 1946/gl; s.n., 1.xii.1947/debd—F. Clement s.n., 1898/ben & occoc—M.A. CLements s.n., Jan. 1905/suav—C.S. Clydesdale s.n., 10.xi.1933/gl—F.B. Cocks 10/gl—P.J. Cole 11/good—D.M. Collins s.n., 26.xi.1953/gl—M.J. Collins s.n., 1923/gl—J.F. Compton s.n., 5.iv.1968/gl—E. Conabere s.n., Oct. 1974/vel—E.F. Constable (all collections s.n.) 17.iv.1947/debd; 16.ix.1947/gl; 26.v.1949/debd; 30.iv.1952/megm; 9.i.1953/debd; 19.i.1953/debd; 22.iii.1955/suav; 18.vii.1955/gl & vel; 27.vii.1955/vel; 9.iii.1957/suav; 23.x.1963/gl—H.M. Cooper s.n., Aug. 1964/mar—B. Copley 146/good; 221/gl; 289/gl; 1073/good; 1133/good; 1252/mar; 1277/good; 1625/mar; 1856/gl; 2084/mar; 2108/mar; 2441/good; 2576/vel; 2708/good; 2730/vel; 3535/vel; 3957/vel—J. Corbin s.n., 24.x.1962/suav—W.H. Cornish s.n., 1885/vel—G.C. Cornwall 199/exc—A.H. Corrick 8/good—A.B. Costin s.n., 6.xi.1948/suav—R. Coveny 460/vel; 10109/debd—A.R. Crawford s.n., 1885/debd—B.C. Crisp 178/vel; 400/vel—M. Crisp 47/vel; 149/good; 256/vel; 518/gl—R.L. Crocker s.n., 27.v.1939/sim; s.n., 2.vi.1939/vel; 28.vi.1939/vel; s.n., 21.vii.1939/vel; 84/exc—O.E. Cronch s.n., April 1913/vel—Cronin s.n., 1893/rot—C. Crossland s.n., 1884/cav & occ—C. Culvenor 304/vel—B. Cumberland 21/gl—G.M. Cunningham 847/sim; 891/gl; 3381/occoc; 4316/good—F.K. Curtin 270/suav—W.H. Cusack s.n., 1896/ben; s.n., 1898/occob—K. Czornij 3/gl; 115/mar; 993a/occoc; 993b/sim; 1098/vel.

I.J. Dale 163/megm—L.G. Dale 283/gl—Dallachy s.n., Rockingham Bay, s.dat./debd T—B.M. Dalton s.n., 4.i.1943/megm—H.V. Dam 22/sim—D. Davidson 128/megm—S. Davies 1/sim; 2/sim; 3/occob; 4/cav; 5/sim; 6/occob; 7/sim—H. Deane s.n., Aug. 1893/gl—G.L. Debney s.n., Aug. 1891/vel—C.M. Deland s.n., June 1954/vel—H. Demarz 2594/rosr; 2631/rosr; 4427/occob; 4823/occoc; 5305/occob; 5668/occob—A. Dietrich s.n., Feb. 1865/megm—W.B. Donaldson s.n., 2.iii.1939/suav—N.N. Donner 24/gl; 360/vel; 491/gl; 747/gl; 1288/gl; 1704/sim; 1952/gl; 3509/vel; 3548/vel; 3750/gl; 4104/gl; 4164/gl; 4253/sim; 4661/good; 5114/vel; 5165/vel; 5235/vel; 5298/vel; 6425/exc; 6495/occob; 6563/exc; 6564/occob; 6583/occob; 6587/exc; 6633/occob—H.M. Douglas s.n., 7.x.1939/vel—Drake s.n., 19.ii.1917/suav—Duchunty s.n., s.dat./gl—W.P. Dunk s.n., July 1950/vel—C.R. Dunlop 3079/debm; 5028/debm—W.N. Dunlop s.n., 4.ii.1972/vel—L. Durrington 511/gl—J.W. Dwyer 124/gl.

E.H.M. Ealey 161/umb T—C.M. Eardley s.n., 13.x.1934/gl; s.n., May 1940/gl— J. Eastburn s.n., s.dat./gl—Eaves s.n., 1872/debd—J. Ebersohn s.n., 28.iii.1962/vel; 135/vel; 259/gl—J.P. Eckert s.n., 1891/mar—Hj. Eichler 12151/gl; 12475/good; 12946/vel; 13751/vel; 17389/occob; 18375/gl; 18392/good; 19452/mar;20174/rot—B. Ellis s.n., 17.ix.1976/vel—F.W. Evans s.n., 18.ix.1953/vel; s.n., 21.x.1953/vel—S.L. Everist 9/vel; S23/suav; 59/megm; 222/megs; 1278/vel; 1660/gl; 2895/megm; 3081/megm; 3140/vel; 3141/vel; 3229/megs; 3230/megs; 3267/megs; 3373/megs; 3375/megs; 3318/occob; 3415/megm; 3516/megm; 3672/megm; 3784/megm; 4110/vel; 5019/megm; 5603/vel; 5651/vel; 5710/vel; 5767/vel; 5891/vel; 6115/megm; 7223/gl; 7442/vel.

R.P. Falla 15/vel—T. Fatchen s.n., 29.xi.1976/mar; Q51/gl; Q55/good—I. Felstead s.n., 1878/good—M. Fetherston s.n., Aug. 1962/rosi & vel—R. Filson 1355/vel; 1356/vel; 1357/sim; 3291/vel; 3319/vel; 3454/vel— H.H. Finlayson s.n., s.dat./exc; s.n., Jan. 1934/occob; Dec. 1934/vel—H. Finnemore s.n., Dec. 1928/gl—W.V. Fitzgerald s.n., Nov. 1903/rot; s.n., April 1905/occoc—H. Flecker 4332/mar—J. Flierl s.n., 1883/vel—N.C. Ford s.n., 1.ix.1946/gl—N. Forde 89/vel; 510/vel; 539/vel; 902/exc; 914/exc—J. Forrest s.n., 1878/occoc; s.n., 1881/rot; s.n., Gascoyne River, 1882/cav; s.n., north of Shark Bay, 1882/sim—W. Forsyth s.n., 24.ix.1898/suav—L.S. Francis s.n., 8.v.1953/exc—W.D. Francis s.n., March 1920/debd & gl—L.R. Fraser s.n., 7.x. 1935/gl—E.F. Fricke s.n., s.dat./suav—W.W. Froggatt s.n., Oct. 1928/gl—Fullager s.n., s.dat./suav.

G. Gardiner s.n., 12.viii.1962/vel; s.n., 20.x.1963/good; s.n., 14.vi.1969/occob; s.n., 3.viii.1969/good—H.G. Gardiner 10/rosr—C.A. Gardner s.n., July 1924/rosr; s.n., 25.vii.1927/cav; s.n., July 1931/occob; s.n., 2.viii.1939/rot; s.n., Sept. 1941/occob; s.n., Aug. 1959/cav; 2319/rosr; 2350a/cav; 2444a/cav; 6066/occob; 6070/occob; 6124/occob; 6170a/occob; 6461/rot; 7537a/rot; 7797/cav; 7904/rosr; 12035/cav—A.S. George s.n., 16.ii.1965/rot; s.n., Sept. 1972/occh; 698/rosr; 721/rosr; 743/occob; 811/rosr; 1149/occoc; 1293/occob; 2169/gl; 2495/occoc; 2511/rosr; 2561/occ; 2741/cav; 2838/cav; 3730/rosr; 3803/occob; 3837a/rosr; 3837b/sim; 3921/occob; 4036/rosr; 4209/rot; 4471/rosr; 4491/cav; 4539/rosr; 4648/rosr; 4844/occob; 5113/sim; 5165/occob; 5250/occob; 5292/occob; 5549/sim; 5645/cav; 6016/rosi; 6544/occ; 6605/occoc; 7363/rot; 8166/occob; 8217/rosi; 8527/good; 8773/rosi; 8818/ben; 8858/occob; 8870/ben; 8996/ben; 9016/occob; 11386/occh—M.C. George s.n., 16.iii.1963/occob—A.V. Giblin s.n., 27.iv.1928/vel—E. Giles s.n., s.dat./exc; s.n., s.dat./vel; s.n., 1875/sim & vel; s.n., 1880/vel—W. Gill 47/vel—C.H. Gittins 369/amp; 696/megs; 1895/gl; 2037/gos; 2103/exc; 2445/ben—L. Glauert B2703/rosr—D.W. Goodall 629/occoc; 630/occoc; 2460/good—R.H. Goode 84/gl—Gosse 243/gos T—R.A. Gould s.n., 29.ix.1966/exc; s.n., 24.iv.1967/ben—D. & H. Gratte 5/rosr—J.W. Green 11/gl; 69/good—L. Griffiths s.n., Sept.-Oct. 1958/occob—G. Gross s.n., 24.viii.1948/gl; B75/gl—Guppy S.II.4/ben.

Hackhouse s.n., 1881/debd—Hactor s.n., Sept. 1924/vel—E.J. Hadley s.n., May 1907/megm—L. Haegi 621/good; 866/good; 918/gl; 1105/rosr; 1151/rot; 1283/occob; 1355/suav—W.R. Haig s.n., Sept. 1885/gl—H. Haigh & L.D. Williams 6435/gos—R. Hannon s.n., Feb. 1909/gl—D. Hardy s.n., 13.vii.1966/cav—J. Hargreaves W154/megm—W.E. Harney s.n., 1.viii.1935/ben—Hartman s.n., 1873/megm; s.n., 1882/megm—Hasser s.n., 4.xi.1960/gl—H.C. Hayes s.n., Kyogle, s.dat./debd—R. Helms (all collections s.n.) May 1891/vel; 17.v.1891/sim; 7.vi.1891/sim; 11.vii.1891/exc; 12.vii.1891/exc & vel; 24.viii.1891/rosr; Camp 52, 15.ix.1891/occob & rosi; Camp 53, 15.ix.1891/occob T; 17.ix.1891/rosi; 21.ix.1891/rosi; 25.ix.1891/rot; 14.x.1891/rosi; 23.x.1891/exc; 26.x.1891/rosi & rot; 28.x.1891/rosi; Oct. 1898/occob; 26.iv.1900/suav—R. Henderson 294/debd; 488/debd—J. Hennelly 92/gl—L. Henry s.n., s.dat./vel—N.M. Henry 598/vel; 792/ben—T. Henshall s.n., Jan. 1966/suav; s.n., 25.iv.1968/good; s.n., 3.viii.1968/vel; 698/gl; 871/good—T.S. Henshall 383/ben; 1341/vel—D.A. Herbert s.n., Oct. 1919/rot—W. Heron s.n., Sept. 1908/suav; s.n., Feb. 1909/gl—A.R.R. Higginson s.n., Oct. 1955/mar; s.n., ca 1955/occob—Hill s.n., 10.xi.1953/occoc—A.V. Hill s.n., 19.xi.1963/suav—F.L. Hill 159/vel—R. Hill 477/vel—F.M. Hilton s.n., 21.viii.1955/good; 544/gl; 653/vel; 835/vel; 1023/good; 1437/sim; 1455/vel; 1472/vel; 1485/vel—P. Hind 43/vel—D. Hockings s.n., May 1957/deb—F.D. Hockings 491/amp—Holding s.n., 1889/gl & vel—A.A. Holland s.n., 6.v.1953/megm—P. Horton 174/gl; 187/vel; 191/vel; 192/sim; 193/sim; 194/occob; 195/sim; 196/occob; 198/vel; 199/sim; 200/vel; 201/occob; 202/good; 203/mar; 204/mar; 205/mar; 206/gl—A.G. Howitt s.n., Sale, s.dat./gl—F. Hughes s.n., March 1920/gl—D. Hunt 744/gl; 3312/mar; 3415/mar—H. Hurst s.n., 1882/gos; 1892/vel—P. Hussey 68/good.

N. Ioannou 25/good—Irvine s.n., 1889/gl & sim—E.H. Ising (all collections s.n.) 29.v.1915/vel; 3.vi.1912/gl; 8.ix.1920/good; 11.ix.1920/good & vel; 15.ix.1920/good; 17.ix.1920/good; Oct. 1922/good; 22.x.1928/good; 23.x.1928/vel; 16.x.1930/mar; 21.viii.1931/vel; 22.viii.1931/ros & sim; 23.viii.1931/vel; 19.viii.1932/vel;

19.viii.1933/vel; 30.viii.1933/rosi; 25.xi.1934/mar; 7.i.1936/gl; 31.vii.1936/rosi; 3.xi.1936/good; 22.viii.1937/vel; 7.ix.1938/mar; 10.ix.1938/mar; 23.ix.1939/mar; Sept.-Oct. 1949/sim; Oct. 1950/sim; 29.vii.1952/vel; 20.ix.1952/exc; 16.vii.1955/sim; 27.vii.1955/sim; 14.viii.1955/sim; 25.viii.1955/sim & ?gl x sim; 26.viii.1955/sim; 2.ix.1955/sim; 14.x.1960/mar.

E.N.S. Jackson 159/vel; 442/vel; 1723/vel; 1852/vel; 1911/vel; 2497/mar; 2739/vel; 2757/vel—G. Jackson 508/gl; 840/mar—G. Jacob s.n., Oct. 1966/vel—S. Jacobs 1303/megs; 1923/gl; 2177/vel; 2227/sim; 2306/gl; 2353/suav—V. Jaegermann 344/gl—James 71/gl—H. James s.n., Nov. 1911/debd—A.E. Jensen s.n., 25.vi.1967/vel—B. Jephcott s.n.,/vel—F. Jessup s.n., 25.xi.1957/vel—L.A.S. Johnson (all collections s.n.) 30.ix.1945/gl; 22.v.1951/debd; 16.iv.1952/suav; 15.vi.1954/suav; 31.x.1954/suav; 3.vi.1955/vel; 4.vi.1955/vel; 18.iii.1959/vel; 23.x.1959/debd; 6.ix.1960/debd; Jan. 1968/debd—L.A.S. Johnson & A. Rodd 1252/debd—R.W. Johnson s.n., 12.x.1954/megm; 500/megm; 751/megm; 1699/gl; 2814/debd—J.G. Johnstone s.n., 25.ix.1915/vel—S. Johnstone s.n., 1883/suav—Jones s.n., 1889/vel—W.T. Jones 1767/megm.

G.M. Kelly s.n., April 1913/megm—J. Kelsall s.n., 21.i.1960/rot—H. Kempe s.n., 1879/gos & occob; s.n., 1881/gos; s.n., 1885/rosi—K.F. Keneally 4181/ben—B. Kennedy s.n., 1885/sim; s.n., 1886/sim—H. Kenny s.n., 2.iv.1917/gl—R.F.B. Kerr s.n., 14.iv.1955/vel—D. Kimber s.n., 24.vii.1977/ben—G. King s.n., 1895/suav—H.S. King s.n., 1886/occ; s.n., 1887/cav—F.H. Kleinschmidt 139/gl—Knox Grammar School s.n., 8.ix.1950/gos—M. Koch (all collections s.n.) 1897/sim; March 1898/sim; May 1898/gl & sim; Aug. 1899/exc, sim & vel; April 1900/gl; 2.x.1923/rot—D.N. Kraehenbuehl 181/mar; 745/vel; 2672/mar—E.C. Kramer s.n., Harper Springs ?1933/rosi T—R.H. Kuchel 144/ben; 214/rosr; 388/occob; 392/occob; 422/exc; 461/gl; 605/vel; 607/sim; 694/vel; 783/vel; 882/vel; 1101/vel; 2940/vel.

D. Laing s.n., June 1961/gl—J. Landy s.n., 4.xi.1960/vel; s.n., 6.xi.1960/gl—R.T. Lange s.n., 17.iii.1962/good—P.K. Latz s.n., 11.ii.1967/gos; s.n., 1.iii.1967/rosi; 133/good; 134/mar; 239/vel; 355/gos; 364/vel; 629/vel; 642/ben; 643/megs; 689/vel; 703/ben; 721/vel; 777/exc; 778/gos; 785/megs; 786/gos; 818/gos; 834/occob; 869/gos; 891/occob; 894/exc; 954/occob; 955/rosi; 1025/gos; 1032/megs; 1051/megs; 1059/megs; 1182/megs; 1273/gos; 1659/megs; 1699/rosi; 1981/rosi; 2145/vel; 2154/megs; 2271/megs; 2394/rosi; 2484/megs; 2500/megs; 2501/megs; 2503/megsT; 2503B/megs; 2548/ben; 2549/megs; 2571/megs; 2613/ben; 2662/ben; 3139/occob; 3153/occob; 4104/occob; 4107/sim; 4150/occob; 4153/sim; 4187/ben; 4188/occob; 4191/sim; 4191B/sim; 4204/occob; 4215/gos; 4302/megs; 4325/occob; 4342/occob; 4431/megs; 4654/occob; 4606/vel; 4666/occob; 4686/rosi; 5063/occob; 5081/sim; 5082/occob; 6757/rosi & sim; 6803/sim; 6814/sim; 6869/sim; 6917/megs; 7095/sim; 7116/exc—D. Law s.n., 31.v.1963/gl—B.A. Lay 15/gl; 147/vel; 252/sim; 333/vel—M. Lazarides 5960/vel; 5963/megs; 6060/rosi; 6087/vel; 6192/vel; 6195/gl; 6292/ben; 8196/vel; 8339/rosi; 8352/rosi; 8388/vel—Leichhardt s.n., 18.xi.1843/debd & megm—J.H. Leigh S74/vel; W208/vel—E.E. Lord s.n., 11.iv.1950/exc—T.R.N. Lothian 248/vel; 251/vel; 367/vel; 529/vel; 622/vel; 647/occob & sim; 683/vel; 767/gl; 812/sim; 872/vel; 1069/occob & vel; 1118/vel; 1130/mar; 1180/good; 1401/vel; 1411/vel; 1499/vel; 1641/vel; 1771/vel; 1912/vel; 1956/vel; 1990/vel; 2014/vel; 2037/vel; 2109/vel; 2171/sim; 2294/sim; 2326/gl; 2393/vel; 2426/sim; 2565/vel; 3000/vel; 3176/vel; 3212/vel; 3399/vel; 3458/vel; 3505/vel; 3653/good; 3893/vel; 4369/sim; 4406/rosi; 4421/rosi; 4526/vel; 4784/sim; 4928/occob & sim; 5108a/vel; 5219/vel; 5544/occob; 5593/good—J.M. Luckie s.n., 28.v.1938/suav—H. Ludeman s.n., 5.vi.1955/rot—H. Lynch s.n., March 1912/gl—R.G. Lyons s.n., 15.ix.1971/vel.

D. McAlpine 35/suav—E.J. McBarron 3071/gl; 5716/gl—J. MacCallum s.n., Nov. 1930/megs—J.D. McCormish s.n., Nov. 1936/debd—E. McCrumm s.n., July 1959/good; s.n., s.dat./cav & rosr—T.J. McDonald 72/megm—K.J. McFarlane s.n., 14.viii.1960/vel—D.J. McGillivray 2880/vel—C.L. Mackay s.n., 9.viii.1961/vel—J. Mackay s.n., Oct. 1890/sim—J. McKean 1183/debm T—D. McKechnie s.n., Jan. 1916/gl— H.S. McKee 295/suav; 6784/suav; 8564/vel; 8570/megs; 8576/rosi—E.N. McKie s.n., 19.iv.1939/sim—H.E.S. McLean s.n., 6.i.1957/gl—K. McMahon s.n., 1952/occ—C.J. McMaster s.n., Sept. 1907/gl—A. McPhee s.n., 1890/ben—W. McPherson s.n., 1897/cav—C.T. Madigan s.n., Sept. 1944/rosi—A.J. Mahood s.n., 16.ix.1958/vel—J.H. Maiden (all collections s.n.) Aug. 1899/gl; Nov. 1899/megm; Jan. 1907/mar; March 1909/megm; Sept. 1909/rosr; 21.ii.1913/gl—R.B. Major 1/exc; 50/rosr—E. Marks s.n., Aug. 1967/vel—Marshall s.n., Feb. 1973/good—P. Martensz s.n., 4.xii.1968/gl; 173/suav—W.J.G. Martin s.n., 14.iv.1967/vel—F.A. Mason 207/mar—Z. Mbar 15/gl—A. Meebold 1593/gl; 21869/suav—R. Melville 3150/suav; 3451/megm; 4058/occob; 4225/rot—O.E. Menzel s.n., Oct. 1897/gl—E. Merrill s.n., 1890/rot—J.V. Mertin s.n., 1.vi.1965/good; s.n., 30.x.1965/sim—N. Michael s.n., s.dat./gl & megm; 1257/debd—J.F. Miles s.n., 26.iv.1956/megm—P.L. Milthorpe 729/vel—A. Mitchell s.n., 17.viii.1968/suav—E. Mjöberg s.n., 11.viii.1911/occoc T—Moore 823/suav—C.W.E. Moore 3623/gl; 4068/vel; 4144/sim; 4257/gl; 4281/sim; 4615/suav; 4764/gl; 4832/sim; 5758/sim; 6260/sim; 6320/vel—S. Moore s.n., April 1895/rosr T—V.K. Moriarty 765/debd—A. Morris s.n., 24.iv.1920/gl; s.n., 2.x.1920/sim; 4.x.1920/vel T—A. Morrison s.n., 11.x.1905/occoc—J. Morrissey 31/rosr—L. Morton s.n., 1881/vel—P.H. Morton s.n., July 1917/gl—W.E. Mossingham s.n., 1889/occ—Muir s.n., 1880/rot—E.T. Muir s.n., 1947/gl—T.B. Muir 900/gl; 901/vel; 2088/suav; 2845/suav—W.E. Mulham 455/sim; 848/vel—A.W. Muller s.n., Dec. 1906/vel—B.J. Murray 19/gl; 106/vel; 430/vel—J. Muspratt 92/debm—J.L. Must 82/vel; 130/vel—P. Myerscough s.n., s.dat./gl.

J.C. deNardi 769/vel; 1025/gl—I.C. Neale s.n., 1888/gl—D.J. Nelson 31/vel; 59/vel; 415/rosi; 497/sim; 583/vel; 628/vel; 719/vel; 875/vel; 876/vel; 1329/vel; 2150/vel; 2213/occob; 2321/sim—A.I. Nesbitt s.n., 25.x.1971/megm—A.O. Nicholls 895/occob—J.B. Nugent s.n., Jan. 1923/gl.

J. Oliver s.n., 1881/good; s.n., 1882/good—R.M. Oliver s.n., 1.vii.1918/gl— M. Olsen & N.B. Byrnes 3560/amp—A.E. Orchard 40/good; 177/gl; 188/good; 229/vel; 253/vel; 348/gl; 350/vel; 763/vel; 780/vel; 964/gl; 1769/good; 2064/good; 2895/good; 3193/good—T.G.B. Osborn (all collections s.n.) 27.v.1922/ vel; 30.v.1922/vel; 24.viii.1922/good & vel; 23.viii.1923/vel—P. O'Shanesy 292/gl.

T.B. Paltridge s.n., 15.ii.1930/good; s.n., 23.viii.1930/sim—S.A. Parker 169/gl—R.A.S. Patterson s.n., 8.xi.1922/suav—R.N. Peacock s.n., 1900/sim—K. Peake-Jones s.n., 28-31.viii.1952/vel—R.D. Pearce 33/vel; 64/vel; 103/good; 112/cav; 123/good; 130/vel; 135/sim; 138/vel; 140/sim; 141/sim; 143/good; 145/vel; 147/mar—L. Pedley 764/megm; 2441/sim; 2465/vel—R.A. Perry s.n., Feb. 1938/gl; s.n., Aug. 1943/vel; 2269/ben; 3417/rosi; 3497/gos; 5338/rosi; 5371/vel; 5392/vel; 5407/vel; 5417/vel; 5451/vel; 5451A/vel; 5472/vel; 5473/vel; 5484/vel; 5507/sim; 5529/sim; 5537/sim; 5538/sim; 5550/sim; 5556/ben; 5567/good—H.T. Phillips s.n., Sept. 1953/exc—M.E. Phillips s.n., 3.ix.1962/ good; 106/gl—M.A. Picard 5/gl—J. Pickard s.n., 16.ix.1970/debd; 1931/good; 1932/gl; 2357/vel; 2755/debd; 3058/vel; 3138/gl; 3139/vel—J.M. Pidgeon s.n., 20.viii.1939/vel; s.n., 21.viii.1939/gl—J. Pike s.n., 5.ix.1960/good— O.M. Pink 87/vel—Pitcher s.n., 12.xi.1909/suav—E. Plozza s.n., 21.x.1972/gl—A. Popplewell s.n., 6.iv.1960/gl—R. Pullen 4173A/suav; 10488/gos; 10506/rosi—J.D. Purdie s.n., 15.iii.1966/gl—R.W. Purdie 103/megm; 519D/vel.

R. Rae s.n., 24.ix.1937/vel—J. Randles s.n., 8.vi.1971/vel—R.A. Ranking s.n., May 1880/megm—L. Reese s.n., 1933/vel; s.n., March 1924/vel—H. Reeve 372/gl—W.S. Reid s.n., 21.vi.1967/exc—E. Reuss s.n., April 1915/gl; s.n., June 1921/vel—Richards s.n., 1879/good T; s.n., 1880/good—A.F. Richards s.n., Sept. 1890/sim; s.n., 1893/mar—I.P. Richards s.n., Oct. 1886/vel— R. Richards s.n., 20.v.1947/gl—A.E.V. Richardson s.n., March 1931/good; s.n., July 1937/vel—L. Richley M66/vel; F107/sim; 1052/sim; 1162/vel; 1385/sim—I.G. Ridgway s.n., 13.v.1979/vel—E.F. Riek & I. Common 200/gl—C.E. Rix 25/rosi—F. Robbins s.n., Werribee Gorge, ca 1935/suav; s.n., Bete Bolong, ca 1937/suav; s.n., Deddick River, ca 1937/suav; s.n., 27.v.1947/gl—A.E. Roberts s.n., Feb. 1920/megm—J. Robertson s.n., 1894/cav—A. Robinson s.n., Sept. 1959/ben; s.n., June 1972/ben—A. Rodd s.n., Dec. 1965/suav; 412/suav; 1883/gl—F.A. Rodway 6561/suav; 6562/debd; 6564/gl; 6565/gl; 6566/gl; 14253/gl—R. Roe s.n., Oct. 1937/megm—K.C. Rogers s.n., 10.i.1962/suav—R.S. Rogers s.n., Sept. 1907/good—K.D. Rohrlach 549/gl; 712/vel—I. Romano s.n., Nov. 1974/megm—R.A. Rose 128/rot—L.A. Rowe s.n., May 1948/gl—R.D. Royce s.n., Aug. 1936/gl; TS236/occob; 1781/ben; 1977/rosr; 1984/rosr; 2001/occob; 4425/rot; 5923/occh; 6014/occh; 6467/ben; 6508/ben; 9700/rot—H.M.R. Rupp s.n., Sept. 1896/suav; s.n., 6.vi.1927/debd; s.n., Oct. 1927/debd; s.n., Nov. 1932/vel—J.F. Ryan s.n., Aug. 1961/vel.

M.C. Saddler s.n., 17.viii.1967/vel—G.R. Sainty 217/suav—H. Salasoo 1641/suav; 1803/gl—O.H. Sargent s.n., 5.iii.1922/rot—G.V. Scammell s.n., 3.xi.1923/suav—E. Schneider s.n., 1871/megm—M. Schneider s.n., 9.vii.1964/gos; s.n., July 1968/vel; s.n., 8.iv.1970/rosi—R. Schodde 473/vel; 712/gl; 735/good; 830/vel; 831/vel; 981/vel; 1051/mar; 1080/gl—D. Scoles 9/vel—H.R. Seddon s.n., April 1924/vel—W. Semple 740/gl—T.L. Setter 260/occob; 292/rosr; 363/rosr—M.C.R. Sharrad s.n., 14.viii.1960/mar; 286/mar; 308/gl; 1405/vel; 1431/good—R.C. Shearer 123/good—C.J. Shepherd 128/gl; 131/gl; 721/gl—C.J. Shepherd & M. Gray 5632/suav—P. Short 5/gl—J.H. Simmonds s.n., June 1887/debd; s.n., 26.i.1888/debd—L.S. Smith 365/gl; 612/megm; 907/vel; 3461/debd; 4419/gl—T. Smith s.n., 26.v.1967/mar; 452/mar; 1954/gl—W. Smith s.n., Dec. 1932/megm—W.F. Snewen s.n., March 1948/amp—R.V. Southcott s.n., 29.ii.-1.iii.1964/gl—R.L. Specht s.n., 3.iv.1950/gl; 2214/good; 2840/good—N.H. Speck 640/rosr; 940/rosr; 996/occob; 996A/cav; 996B/occob; 1008/cav; 2009/gl—A.G. Spooner 1878/good; 2855/good; 3227/mar; 3370/good; 3588/mar; 4291/vel; 4306/mar—M.S. Stevens s.n., Dec. 1954/amp; s.n., 29.xii.1954/megm & vel—P.R.H. St John (all collections s.n.) 5.iv.1899/suav; 21.iii.1901/suav; 29.ii.1904/suav; 12.iii.1904/gl & suav; 13.iii.1904/gl; 11.x.1906/suav—G.M. Storr s.n., 6.ix.1959/occh; s.n., 14.ix.1959/occh; s.n., 22.x.1961/occh—C. Stout s.n., 16.ii.1913/gl—K. Stove 562/occob; 680/sim—W.F.M. Straatmans 23/suav—H. Suijdendorp 117/umb—R. Swinbourne 355/megs; 372/rosi; 384/megs; 397/rosi; 428/vel; 1402/gl—G.D. Swincer s.n., 14.x.1961/gl—D.E. Symon s.n., 27.v.1953/vel; s.n., 2.vi.1953/vel; s.n., 5.vi.1953/gos; s.n., 6.vi.1953/gos & vel; s.n., 10.vi.1953/rosi; s.n., 12.vi.1953/exc; s.n., 14.vi.1953/gos; s.n., 15.vi.1953/gos; s.n., 17.vi.1953/exc; s.n., 18.vi.1953/vel; s.n., 30.iii.1958/mar; s.n., 27.ix.1959/good; s.n., 30.ix.1959/good; s.n., 16.xi.1965/rosr; s.n., Sept. 1968/gl; 522/good; 662/vel; 1301/gl; 1155/good; 1883/good; 2082/good; 2459/ben; 2472/rosr; 2562/exc; 2709/sim; 3045/vel; 3046/gl; 3214/mar; 3292/vel; 3336/exc; 3563/gl; 3652/good; 3786/good; 3792/vel; 3870/good; 4000/vel; 4500/good; 4555/good; 4627/good; 4657/good; 5458/cav; 5580/gl; 5691/vel; 5848/vel; 6030/vel; 6071/occob; 6533/mar; 6613/mar; 7288/vel; 7294/gl; 7326/vel; 7428/gl; 8016/gl; 8027/vel; 8112/vel; 8333/gl; 8818/good; 8855/mar; 8927/mar; 9013/mar; 9076/sim; 9142/sim; 9180/sim; 9263/sim; 9299/vel; 9422/vel; 9459/vel; 9899/good; 9904/vel; 9905/good; 9914/sim; 9926/occob; 9949/cav; 9960/rosr & sim; 10385/rosi; 10561/gl; 10563/mar; 10581/vel; 11028/vel; 11225/vel; 11287/occob; 11287A/sim; 11288/sim; 11288A/sim; 11445/sim; 11448/gl; 11468/sim; 11472/sim; 11544/vel; 11559/vel.

Tadgell s.n., April 1910/gl—R. Tate s.n., 1894/rosi—A. Taylor s.n., 20.vi.1957/debd—G.F. Telfer 101/vel—J.G.O. Tepper s.n., 1879/good & mar; s.n., March 1880/gl; s.n., s.dat./gl—A.R. Tewksbury s.n., Feb. 1949/suav—R.J. Thiele s.n., 22.viii.1970/gl—D.F. Thompson 1709/megm—J. Thompson 1068/gl; 1118/megm—R.F. Thornton s.n., 1889/gos & vel; s.n., 1891/gos—W.H. Tietkens s.n., 1889/gos—N.B. Tindale s.n., 11.vii.1933/exc; s.n., 8.xi.1934/vel; 22.ix.1953/ben—A. Tiver s.n., 5.xii.1978/vel; s.n., 12.xii.1978/good—M.A. Todd s.n., 16.i.1966/gl—H.R. Tolken 6328/occoc; 6329/ben; 6355/occoc; 6378/occoc; 6407/occoc—

J.G. Tracey s.n., 1958/debd; C280/debd—H. Tryon s.n., 1909/gl—Tucker s.n., 1879/vel—E.M. Tucker s.n., 14.vi.1969/vel—E.C. Tuckwell s.n., May 1954/gl—R. Tully s.n., March 1893/gl—A.J. Turner s.n., Sept. 1920/megm—H. Turner (all collections s.n.) 11.ii.1960/good; 20.ii.1960/good & occob; 23.iii.1960/occob; 21.viii.1960/good; 4.ix.1960/good; 26.ix.1960/occob—F.T. Turvey (all collections s.n.) 16.iv.1966/sim; 21.v.1966/exc; 2.vii.1966/sim; 15.viii.1966/gos; 3.viii.1968/exc; 11.viii.1968/gos—I. Tyson s.n., 1892/occob & sim.

F.H. Vachell s.n., Dec. 1903/rot—J. Vickery s.n., 20.xii.1934/gl; s.n., 19.viii.1946/vel—R.S. Vickery s.n., 3.i.1957/good; s.n., 5.i.1957/good—A. Vogan s.n., 1889/sim & vel.

N.A. Wakefield 3928/suav—Wallace s.n., July 1972/gos; s.n., 12.viii.1973/gos—N. & P. Wallace s.n., June 1973/gos—H. & J. Walsh s.n., 1894/occob—C. Walter s.n., Sept. 1899/suav—C. Walters s.n., 1898/rot—Warburton s.n., s.dat./vel—H.M. Ware s.n., Oct. 1949/suav; s.n., Aug. 1950/suav; s.n., 17.vii.1951/gl; s.n., 8.xii.1954/suav—C. Warner s.n., Aug. 1955/sim—F.D. Warren s.n., s.dat./vel—J.T. Waterhouse s.n., Jan. 1948/megm; s.n., May 1954/gl—F.J. Webb s.n., May 1901/vel—J. Webb s.n., 19.ix.1957/suav—L.J. Webb 2276/debd & megm—J.Z. Weber 550/gl; 666/gl; 794/occob & sim; 977/gl; 981/vel; 1221/vel; 1344/vel; 1437/vel; 1520/vel; 2069/vel; 2110/vel; 2264/vel; 2399/vel; 2562/gl; 2632/vel; 3328/vel; 3331/gl; 3415/gl; 3508/gl; 3561/good; 3649/good; 3777/gl; 3885/mar; 3908/mar; 4558/vel; 4654/vel; 5259/occob; 5260/occob; 5273/occob; 5391/occob; 5477/occob; 5580/exc; 5685a/sim; 5685b/vel; 5719/vel; 5798/vel; 5938/vel—L. Webster s.n., 1898/rot—J. Wedd s.n., Nov. 1891/debd—H.J.N. Wehl s.n., 1892/megm—M.G. West s.n., 15.x.1972/gl—A. Weston s.n., 1892/occ—T. & J. Whaite 1947/suav—Wheeler s.n., s.dat./vel—J.R. Wheeler 444/gl; 790/mar—D.J.E. Whibley 259/good; 568/good; 889/gl; 1117/rosr; 1122/exc; 1156/sim; 1184/exc; 1250/vel; 2150/vel; 2209/vel; 2222/gl; 2313/gl; 2316/vel; 2362/vel; 2370/vel; 2466/vel; 2513/vel; 2572/vel; 3416/vel; 3431/vel; 3493/vel; 3571/vel; 3871/vel; 3981/vel; 4004/gl; 4062/vel; 4424/vel; 5473/good; 4577/gl; 6415/occob; 6569/occob—C.T. White s.n., March 1915/gl; s.n., 13.v.1917/debd; 10394/megm; 10881/debd; 11359/debd; 11656/megm; 12018/vel; 12019/vel; 12228/megm; 12488/debd; 12559/debd—S. White s.n., s.dat./vel—S.A. White s.n., s.dat./vel; s.n., 12.viii.1914/exc T; s.n., 23.viii.1914/vel—D.G. Wilcox s.n., 7.vii.1970/occob; 63/occob—C. Wilhelm s.n., s.dat./mar; s.n., March 1857/suav—M.C. Willcocks 20/good—K. Williams 89/vel—L.D. Williams 578/mar; 1596/gl; 2831/vel; 3493/gl; 5252/mar; 6386/vel—Williamson s.n., Hopetown, s.dat./suav—J.H. Willis (all collections s.n.) 29.viii.1947/good; 29.viii.1948/vel; 10.ix.1950/vel; 11.ix.1950/vel; 20.x.1955/suav; 27.v.1961/debd; 18.x.1961/good; 22.ii.1962/suav; 11.iii.1963/suav; 5.ix.1963/good; 11.ix.1965/gos; 20.viii.1966/vel; 23.vii.1966/vel; 28.vii.1966/gos; 13.v.1969/suav; 30.ix.1969/suav—V. Willis s.n., May 1920/gl—K.L. Wilson 1295/megm; 1612/gl; 1916/megm—P.G. Wilson s.n., 28.ii.1954/gl; 129/gl; 480/mar; 569/gl; 1631/good; 1659/good; 1682/good; 1689/gl; 2178/good; 2546/occob; 2590/sim; 3911/rot; 7221/occob; 7650/good; 10504/occob—J. Wilton s.n., Jan. 1914/gl—R.E. Winkworth 26/vel; 479/vel; 601/vel; 795/gl; 1233/vel; 1374/rosi—C. Winnecke s.n., 1883/ben & rosi—G. Wittmann s.n., 27.viii.1964/vel—S.T. Woenne 104/occob—J. Womersley 4/gl—W. Woolley s.n., 1871/megm; s.n., 1886/vel—Woskett s.n., 14.x.1955/exc—J.W. Wrigley 5903/gl—A. Würfel s.n., Oct. 1884/gl & vel—Wuth s.n., 1870/megm—E.S. Wyndham s.n., March 1919/gl.

Index of Latin Names

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